Innovation@iitkanpur

Indian Institute of Technology Kanpur
FOREWORD

IIT Kanpur has always been considered as one of the best research institute even among the IIT system. In recent years IIT Kanpur has made rapid strides in the management of its IP and commercialization of the same. The technology transfer cell of IIT Kanpur has patented around 150 patents over the last four years and out of which around 21 have been successfully commercialized. As an attempt to further the process of commercialization compendium of existing patents is being presented in this booklet. We at IIT Kanpur believe that this would be the first of a series of steps to showcase IIT Kanpur’s research to the industry. We believe that this sharing of knowledge will enable the industry academia interaction process. The Research and Development office at IIT Kanpur looks forward to assisting and accelerating this interaction and hopes to contribute to the wealth creation of the nation.

Dean of Research and Development
Professor A. K. Chaturvedi
Proprietary Technologies
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## Chemical and Life Sciences

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Transportation

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- Estimation of Inertia Tensor and Centre of Gravity of a Vehicle on the Three Axes Platform and a Test Rig used thereof
- An Arrangement for Jet Engine to Reduce Noise
- A Multipurpose Transporter with Modular Configuration
- The Drift-Battery Operated Campus Vehicle
- A Self Propelled Stair Climbing Wheel Chair
Chemical and Life Sciences

Source: http://rechemicals.com/
This is a cell based tool developed to screen to BMP-like drugs which may help treat Osteoporosis

Key Features

- This cell line is developed using genetically modified mouse and a DNA construct has all the necessary ingredients to screen for drugs that may act as BMP

- The construct also contains an antibiotic resistance cassette to ensure selection of stably transfected cells

- A new construct where all the necessary genetic elements are included in one construct

- Unique cell line with improvement of signal to noise ration in BMP signaling

- Incorporated two reporter genes which report BMP-specific reporter activity

Applications

- Screening of BMP agonist drug molecules

- It is the first of its kind cell-based BMP signaling activity measurement tool

- BMP signaling seems to be critical for maintenance of bone health and loss of it seems to be correlated with osteoporosis, an incurable disease at present
Superior and Cost Effective Grease
Feed Stock Form Polyethylene Mixed Waste

Patent Filed

Indian Patent Application No:
614/DEL/2010

Inventors:
Dr. Anil Kumar
Dr. Nitin Kaistha

Department of Chemical Engineering

Process of tailoring the catalyst and reactor operating conditions for high yield of different grades to greases

Key Features

- Extremely high yield of different grease grades are obtained by manipulating reaction conditions

- The grease is miscible with any lubricating oil and its viscosity is adjusted to any level

- No thickening agent is needed

- The grease is thermally stable and requires no antioxidants

- The process uses polyethylene waste as feed material and is extremely cost effective

Applications

- For producing value added products from polyethylene waste as in petrochemical industries
A Needle for Puncturing

Patent Filed

Indian Patent Application No: 3053/DEL/2010

Inventors:
Dr. Animangsu Ghatak
Ms. Susmita Das

Department of Chemical Engineering

Design of a “multi-tip” syringe needle consisting of a cylindrical shell fitted with several closely spaced needle tips at desired orientations

Key Features

• The needle consists of a hollow cylindrical portion which connects at one end to a syringe, the other end remains fitted with a set of closely packed tips

• The tips can be straight, completely or partially conical or differently shaped and can be two, three or more in number

• When constituent tips are widely separated, the puncturing load increases linearly with the (number of tips)

• It cause significantly less trauma during tissue puncture for variety of medical applications

Applications

• Bio-medical applications: drug delivery, blood sampling, tissue suturing and biopsy

• The needle will be useful for multitasking operations

Optical images of the multi-tip needle. Schematic representation of an experiment

Contact: siic@iitk.ac.in
A System for Generating Crystal of Desired Size and Number Density of a Bio-molecule, and Process thereof

Patent Filed


Inventors:
Dr. Animangsu Ghatak
Dr. Anindita Sengupta Ghatak

Department of Chemical Engineering

A system and a process for generating crystals of macromolecules, for example, proteins, peptides, etc., between two substrates wherein either or both of which are topographically and/or chemically patterned

Key Features

- The system comprises of a small volume of the solution of macro-molecule sandwiched between two substrates with a small controllable gap in-between
- At least one of the substrates is patterned with a uniform undulation and sharp kinks of specific number density
- The uniform undulation has periodicity in the range of 100nm-1000nm; and angle of kink generated between two neighboring wrinkles ranges from 0-90 degree
- The process can be used for generating crystals of very small to large size

Applications

- Controlled drug delivery
- Areas of biotechnology which involves large scale generation and easy harvest of crystals

Contact: siic@iitk.ac.in
BFPT Thin Films Heterostructure and Process Thereof

Patent Filed

Indian Patent Application No: 1198/DEL/2008

Inventors:
Dr. Ashish Garg
Dr. D.C. Agrawal
Ms. Soumya Kar
Department of Materials Science and Engineering

Dr. Dhananjai Pandey
School of Materials Science & Technology, IT-BHU

This invention demonstrates the existence of very large ferroelectric polarization and dielectric constant in a polycrystalline film of 0.70BiFeO₃- 0.30PbTiO₃ through precise control of various process parameters during thin films growth

Key Features

- Ceramic bodies of this composition fragment on passing through the Curie point after sintering due to unusually large tetragonality
- Bulk ceramic specimens fragment show extremely high room temperature remnant polarization and dielectric constant

Applications

- Applications in industries engaged in fabricating high temperature ferroelectric/piezoelectric sensors and actuators
**Polymer Matrix Scaffold and Process for Preparation thereof**

**Patent Filed**

Indian Patent Application No: 2851/DEL/2008

**Inventors:**
Dr. Ashok Kumar
Mr. Anuj Tripathi

**Department of Biological Sciences and Bioengineering**

A process for preparation of a polymer matrix and thereby modulating its gradient characteristics

**Key Features**

- A process to generate and control the gradient porosity in the natural polymeric scaffolds
- To generate the anisotropic/gradient characteristics such as porosity, pore size, mechanical strength distribution in the polymeric macroporous hydrogel scaffolds and controlled these characteristics according to choice of application

**Applications**

- Medical implant in cartilage repair
- A method of treatment of cartilage degeneracy
Wound Dressing Polymer Matrix

Patent Filed


PCT filing No. PCT/IN2010/000727

Inventors:
Dr. Ashok Kumar
Ms. Era Jain

Department of Biological Sciences and Bioengineering

An antiseptic polymeric wound dressing in form of an adhesive macroporous hydrogel sheet

Key Features

- The antimicrobial hydrogel sheet will serve as a reservoir of iodine releasing iodine in a controlled manner
- The macroporous hydrogel sheets are advantageous in a manner that they have superior physical properties such as biocompatibility, softness, high absorption of body fluids, by itself
- They do not support growth of microorganism

Applications

- Antiseptic macroporous hydrogel sheets applied to small acute wounds, burns, exudative wounds like dermabrasion, chemical peels, superficial burns, laser wounds, friction blisters including epidermolysis bullosa and ulcers

Contact: siic@iitk.ac.in
A process for generating miniaturized replicas of the original pattern or an object, which is easier and cheaper to fabricate

Key Features

- Can be used to generate features which are smaller than the feature size of the original master pattern
- Miniaturize large 3-D objects in a wide range of length scales: macroscopic to sub micron
- Multiple replicas having different length scales can be simultaneously produced, in different cycles
- The initial pattern can be engraved on a planar or a curved substrate
- The miniaturization can be isotropic or anisotropic

Applications

- In areas of nanotechnology for micro and nano fabrication.
- Components of electronics, optical devices, scaffolds for tissue engineering, biological and chemical sensors, patterned adhesives, carbon MEMS/NEMS, micro battery
A Method and Apparatus for the Formation of Patterns on Surfaces and an Assembly and Alignment of the Structure thereof

Patent Filed

Indian Patent Application No: 2787/DEL/2005

PCT filing No: PCT/IN/0600108

Inventors:
Dr. Ashutosh Sharma
Mr. Manoj Gonuguntala
Mr. S Subramanian

Department of Chemical Engineering

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A lithographic method which enables erasable patterning and in situ transformable patterns in elastomeric films

Key Features

- The novelty of the invention is the use of intermolecular/ intersurface interactions and the instabilities engendered by these soft elastomeric films for the application of lithography

- The invention makes it possible to generate erasable and in situ transformable patterns

- Patterns on a silicon containing elastomeric film can be preserved by exposing the patterns to UV emissions

- A single stamp can yield a multitude of patterns

- The patterns are directly generated in the solid phase

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Applications

- Modern electronic industry, biotechnology display devices, data storage, biological sensors, novel diagnostic applications for lab-on-a-chip devices, MEMS devices microfluidics etc.

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A sketch of the stamp is shown to indicate that the bridges form under the recessed regions of the stamp.
A Process for Synthesis of Polymeric Micro/Nano-Particles for Controlled Delivery Applications

Process for synthesis of polymeric micro/nanoparticles for drug (bioactive agent) delivery applications

Key Features

- Unique single step process for the synthesis of drug/bioactive agent loaded polymeric particles in the micron and sub micron range
- The electrospaying technique has been standardized for the synthesis of natural polymers such as chitosan and gelatine based micro-nano-particulates
- It can be extrapolated for the synthesis of micro-nano-particulates other polymers as well

Applications

- Micro/nano-particulate drug delivery applications
Fixed Bed Hypersorber and a Process for Fraction of Fluid Mixtures using the same

Patent Filed


Inventors: Dr. D P Rao
Mr. Ramaprasad

Department of Chemical Engineering

Coassignee: GAIL India Limited, India

Facilitates fractionation gas mixtures into products of high purity like air into oxygen and nitrogen

Key Features

- A moving-port system was invented which can be used to inject or withdraw gas or liquid into fixed bed of granular material
- The device helps realization of moving-bed of solids in fixed beds
- A process pressure swing cycles were proposed which yields sharp separation of fluid mixtures and carry out reactive separations

Applications

- For separation of gas and liquid mixtures into pure products
- For carrying out reactive separations

Lab unit of Simulated Moving Beds
New Duplex Adsorption Process for Fractionation of Gas Mixture

Patent Filed


Inventors:
Dr. D. P. Rao
Mr. S. V. Sivakumar
Mr. Praveen Kumar

Department of Chemical Engineering

It is a pressure swing adsorption process to yield sharp separation of gas mixtures

Key Features

- A two adsorption bed processes
- Yields to two high purity products without a waste stream

Applications

- Separation of gas mixtures
- Capture of carbon dioxide from flue gases
- Production of oxygen and nitrogen
- Upgrading lean natural gas

Schematic of the proposed CSA

Contact: siic@iitk.ac.in
A Method of Transporting Different Hydrocarbon Liquid Fuels through a Pipeline Without Mixing

Patent Filed

Indian Patent Application No: 1281/DEL/2008

Inventors:
Dr. D.P. Rao
Dr. Nitin Kaistha

Department of Chemical Engineering

Coassignee: Hindustan Petroleum Corporation Limited (HPCL), Process Intensification Consultants, Hyderabad

A gel plug is used to separate the interfaces of different liquid fuels to eliminate the formation of 'slop-cut'

Key Features

- A gel plug of about 5m travels along the interface preventing the mixing

Applications

- Besides eliminating the slop-cut, it would also cleans the pipe line
A Composition and Mechanism to Extend Life Span of an Organism and Protection against Neurodegenerative Diseases

Identification of a drug to extend lifespan and more importantly for protection against neurodegenerative diseases

Key Features

- The composition reserpine
- Modulates neurotransmitter release
- Delays aging
- Increases stress tolerance
- Increases lifespan
- Provides protection against neurodegenerative disease causing toxicities

Applications

- Evaluate against fatal neurodegenerative diseases in patients
- Determine the age delaying effects in various commercially important animals like horses, sheep etc

Contact: siic@iitk.ac.in
Confering Plants with Nematode Resistance

Patent Filed


US Patent application No: 11/783,916

Inventors:
Dr. K. Subramaniam
Mr. Bindhay Chal Yadav

Department of Biological Sciences and Bioengineering

Compositions and method for modulating the expression of a target gene in a target pathogen through a host plant for the pathogen

Key Features

- This invention is primary based on the reasoning that the dsRNA expressed in the host plants will most likely trigger RNAi response in parasites

- A specific set of criterion is used to select the target genes, namely splicing factor and integrase, namely:
  - RNAi for the target gene must work robustly in the free-living nematode C. elegen
  - The function of the target gene must be well conserved in diverse groups of organisms
  - The nucleotide sequence of the target gene should not share a high degree of similarity with other organisms
- Two novel DNA sequences have been used in this invention

Applications

- Farmers, Cut-flower industries and Agricultural biotechnology etc
Process for Preparation of Chiral Y-Lactams

Patent Filed

Indian Patent Application No: 1870/DEL/2010

Inventors:
Dr. Manas K. Ghorai
Mr. Deo Prakash Tiwari

Department of Chemistry

Key Features

- Present patent describes an efficient process for synthesis of chiral Y-lactams from reaction of aziridines and active methylene carbon nucleophiles.

- The reaction utilizes starting materials which are either commercially available or can be easily synthesized in easy no. of steps.

- This patent describes a process where enantiomerically and diastereomERICally pure Y-lactams can be synthesised in a single step.

- Reaction avoids use of any hazardous or toxic material.

Process for synthesis of biologically important Y-lactams

Applications

- Several drugs based on chiral GABA scaffold (e.g. Pregabalin (Lyrica))

- Functional core of various drugs

- This method can be used for synthesis of a large no. of drug like molecules having Y-lactam or GABA core.

Schematic presentation of synthesis of Y-lactams
Process for the synthesis of highly functionalized piperidines in stereochemically pure forms

Key Features

- This patent describes an efficient process for the synthesis of 2,6-disubstituted piperidines in diastereo as well as enantiopure forms starting from simple precursors like substituted 1,3-dicarbonyl compounds and imines.

- The process involves a domino-imino-aldol-aza-Michael reaction sequences, the two steps are being executed sequentially in a single pot operation to afford the corresponding piperidine products in very good chemical yields.

Applications

- Piperidine ring systems are versatile subunits, found in many naturally occurring alkaloids and drug molecules.

- Synthesis of a wide variety of drug like molecules having piperidine ring systems as the common structural element.
Breast Cancer Detection System

Patent Filed


Inventor:
Dr. Siddhartha Panda

Department of Chemical Engineering

A breast cap utilizing highly sensitive flexible temperature sensing elements to detect cancer

Key Features

- This utilizes the paradigm of temperature differences in tissues to diagnose disease
- Flexible temperature sensing elements on a flexible substrate comprise a breast cap which enable better contact with the skin and thus more reliable performance
- Higher temperature sensitivity is achieved
- Design is application specific – thereby enabling customer class specific care.
- Flexible polymeric sensing elements more comfortable than rigid metallic ones
- Easy to fabricate
- Lower cost – benefit can be passed on to the customer

Applications

- In detecting small and sensitive temperature changes in tissues for detection of diseases like cancer

Contact: siic@iitk.ac.in  IIT Kanpur Technologies | 19
Quick synthetic route to prepare biodegradable polymers of glycolic acid (PGA), lactic acid (PLA) & co polymer of both (PLG)

Key Features

- The method involves irradiating the starting materials to microwave irradiation under solvent & catalyst free conditions with an exposure time of about 12-150 mins as compared to 6-12 hrs through conventional thermal polymerization involving a catalyst.

- The PLG polymer shows very good encapsulation efficiency to nano encapsulate tuberculosis drugs such as Rifampicin.

Applications

- Sustained drug release for tuberculosis/anti-cancer drugs
**Process for Nitration of Macromolecules**

**Patent Filed**

Indian Patent Application No: 2350/DEL/2004

**Inventors:**
Dr. Anil Kumar  
Mr. Manohar Lal Malhotra  
*Department of Chemical Engineering*

Mr. Ashish Bhowmick  
*Jubilant Organosys, Noida*

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**Improved method for the nitration of organic macromolecules. More particularly this novel process is developed for gas-solid phase nitration of organic macromolecules employing oxide of nitrogen (NOX) in presence of air.**

**Key Features**

- The oxide of nitrogen consist of nitrous oxide (N₂O), nitric oxide (NO), dinitrogen dioxide (N₂O₂), dinitrogen trioxide (N₂O₃), nitrogen dioxide (NO₂), dinitrogen tetroxide (N₂O₄) or dinitrogen pentoxide (N₂O₅) or a mixture thereof

- The process employs oxide of nitrogen (NOx) in presence of air or its constituents in gaseous phase in ratio of 1:0.25 to 1:2 to produce nitrated macromolecules

- The reaction is carried out in the temperature range of 60°C - 140°C

- The reaction time varies from 3-12 hours

- The solid-gaseous phase nitration of organic macromolecules takes place in a fluidized bed reactor

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**Applications**

- Separation technology
- Automation industry
- Fuel cell
- Protein synthesis & catalysis
A novel process for Kraft Black Liquor recovers clear water and rich inorganic chemicals while obtaining alkali lignin as separate stream

Key Features

- Process for the recovery of inorganic sodium compounds from the Kraft Black Liquor which comprises the following steps:
  - Pressure Carbonation of Kraft Black Liquor by treatment with carbon dioxide
  - The resultant solution is treated by an open Ultrafiltration (UF) membrane in cross flow geometry at a low pressure to separate higher molecular weight fractions of Lignin in the Kraft Black Liquor
  - The permeate of the UF is then subjected to Nanofiltration (NF) which rejects almost all the organic molecules and passes water along with inorganic compounds which are mainly sodium carbonate salt

Applications

- The paper industries following either the Kraft pulping, or soda pulping, or sulphite pulping (acidic, basic as well as based on neutral pH levels) may adopt the developed three-step process.
A Novel in vitro Method of Screening for Anti-Cancer Activity

Patent Filed

Indian Patent Application No: 2841/DEL/2012

Inventors:
Dr. Dhirendra S Katti
Ms. Neha Arya
Mr. Viren Sardana
Mr. Prashant Jha

Department of BSBE

Preparation of a 3-D polymeric scaffold for generation of cancer cell aggregates (tumoroids) for anti cancer drug testing and screening.

Key Features

- Improved in vitro model for studying tumor Biology
- Polymeric scaffold used is synthesized of Chitosan-Gelatin
- The process bridges the existing gap between conventional 2-D culture & in vivo tumors.

Applications

- Industrial Application in the fields of Drug pharmaceutical screening and testing.
- Studying tumor biology
Identification of Vascular Deformations

Patent Filed

Indian Patent Application No: 363/DEL/2013

Inventors:
Mr. Abhinav Parashar
Dr. K Muralidhar
Dr. P K Panigrahi
Mr. Rahul Singh
Mr. Manoj Sharma

Department of Mechanical Engineering

A medical device that monitors physiological flows in the human body with the goal of identifying vascular deformation in blood vessels

Key Features

- It includes an imaging device for the identification of vascular deformation of blood vessels in a human subject.
- A 2-camera particle tracking module determines three instantaneous velocity components of biosensors introduced in the blood vessel.
- Includes a flow statistics calculation module that quantifies the extent of chaos in the moving fluid. The numerical data thus obtained quantifies the degree of vascular deformation.
- A low cost device for vascular deformation that eliminates the need of costly MRI & CT scans.
- The quantity of contrast agent to be provided is small when compared to MRI and CT based angiography.
- Practically non-invasive and uses inexpensive white light.
- Chaotic indicators scale with wall deformation and serve as a numerical count for the appearance of an aneurysm.

Applications

- Industrial Applications in Bio medical, Healthcare automation, medical equipment.
A Biosensor with Improved Specificity

Patent Filed

Indian Patent Application No: 2966/DEL/2012

Inventors: Dr. Siddhartha Panda Dr. Satyendra Kumar

Department of Chemical Engineering

A process for partial recovery of the loss of enzyme by surface immobilization using nanotextured surfaces.

Key Features

- Reuse of enzymes (which are costly raw materials)
- Bio sensors obtained with this process have improved sensitivity.
- The method limits the performance loss of the bio molecules.

Applications

- Enzymatic applications - enzymatic based sensors, enzymatic based reactors.
- Method to mitigate loss of functionality

<table>
<thead>
<tr>
<th>Free</th>
<th>Surface immobilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untagged enzyme</td>
<td>Untagged enzyme</td>
</tr>
<tr>
<td>Tagged enzyme</td>
<td>Tagged enzyme</td>
</tr>
<tr>
<td>Nontextured</td>
<td>Nontextured</td>
</tr>
<tr>
<td>Nanotextured</td>
<td>Nanotextured</td>
</tr>
</tbody>
</table>

Symbols:

- Plate well
- Nontextured silicon
- Nanotextured silicon
- Sequence of Linking molecules
- Enzyme
- Antibody-tagged enzyme
**Novel Fly Tumor Model and Methods of Screening Drugs Thereon**

Patent Filed

**Indian Patent Application No:** 899/DEL/2013

**Inventors:**
Dr. Anjali Bajpai
Dr. Pradip Sinha

**Department of Biological Sciences and Bioengineering**

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**Development of fly tumor model induced by specific gene mutations and its use in screening anti-cancer drugs in vivo**

**Key Features**

- Generating a target-based in vivo screening/testing system for anti-cancer drugs.

- Utilizes the rich genetics of the fruit fly Drosophila

- Optimizing the said system of drug testing wherein the tumors display primitive cell states by genetic manipulation

---

**Applications**

- Use by Cancer drug manufacturers to screen their drugs for efficacy

- Drugs can be tested screened for efficacy on fruit fly to avoid further investments in drugs of lesser efficacies.
A Biodegradable Smoke Filter Material

Patent Filed

Indian Patent Application No: 884/DEL/2013

Inventors: Dr. Ashok Kumar

Department of Biological Sciences and Bioengineering

Biodegradable smoke filter made from natural polymers with simple fabrication technique.

Key Features

- Biodegradable smoke filter material for maintaining clean environment
- Natural polymers for synthesis of filters
- More efficient than conventional filters available
- Porous, interconnectivity with low-pressure drop
- Cost effective & mechanically stable
- Can be used as auxiliary or main stream filter

Applications

- As cigarette filters to eliminate toxic and carcinogenic components
- As filters for use as masks
- Prevent harmful microorganisms like bacteria or viruses and other harmful objects from entering the respiratory system

Figure: Digital images of cigarette filter. Left side: Panel A represents filter material of different length. Panel B represents polymeric filters of different flavors like mint, clove and filter incorporated with carbon. Panel C represents filters in encapsulated form while panel D represents polymeric filters fitted at the back of commercially available cigarettes, respectively. Right side: Scanning electron micrograph image of the inner structure of filter showing interconnected porous channels.
An Electrolyte Insulator-Semiconductor based Microfluidic Immunosensor Device

Method to immobilize different antibodies, capture and detection of antigens in microchannels.

Key Features

- Integration of an EIS unit and a microfluidic unit to form an EIS based microfluidic immunosensor to detect antigens

- In-house provision for bio-functionalization, thereby obviating the need for processing elsewhere

- Maintaining the constant temperature of the substrate during the analysis which is critical for reliability of results.

- Avoidance of cross contamination of the samples by provision of replacement of the flexible tubes

Applications

- Biomedical industry
- Healthcare agencies

Contact: siic@iitk.ac.in
**Novel Drosophila Tumor Model for Screening Anti-cancer Drugs and Methods thereof**

Patent Filed

Indian Patent Application No: 1265/DEL/2013

Inventors:
Dr. Arati Mishra
Dr. Anjali Bajpai
Dr. Pradip Sinha

**Department of Biological Sciences and Bioengineering**

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**Drosophila model for screening anti-cancer drugs targeted against pathway specific signaling pathways, such as Wnt.**

**Key Features**

- Accurate and reliable platform for screening of anti-cancer drugs
- Suitable to screen for putative anti-Wnt signaling molecules.
- Strategy drug screening based on the rationale that loss of select Drosophila tumor suppressors trigger Wnt-mediated carcinogenesis.
- Technique validated by genetic and/or chemical suppression of tumor progression by antagonizing Wnt signaling.
- Advantage of mechanistic understanding anti-cancer drug actions.

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**Applications**

- Pharmaceutical and Drug Industries
An Integrated Microchip for the Detection of a Biological Cell

Patent Filed

Indian Patent Application No: 1787/DEL/2013

Inventors:
Dr. Shantanu Bhattacharya
Dr. Gurunath Ramanathan
Ms. Monalisha Nayak
Mr. Deepak Singh
Mr. Rishi Kant

Department of Mechanical Engineering & Chemistry

Integrated counter, sorter, concentrator and real time PCR based biochip system for sensitive detection of cells.

Key Features

- Design, fabrication and testing of a silicon, PDMS hybrid biochip with integrated capabilities of DEP based concentration, specific sorting of cells and molecular identification of types of cells in a single platform.

- Couples the powerful selectivity of immuno-recognition, the selective high yield capture using dielectrophoresis and the highly specific molecular identification offered by the RT-PCR.

- Detection limit of 103cfu/mL corresponding to 30 bacterial cells with a capture yield of 75% and a total assay time of less than 3 hours.

- The invention claims to produce a complete lab-on-a-chip for DNA sequencing applications in which the whole DNA sequencing steps (amplification, purification, electrophoresis) would be integrated on a bio chip using nano litre-scale sample volumes. The sequencing can be performed both bacterial and mammalian cells.

Applications

- Cell detection in the food, water samples.

- Pharmaceutical company, Research labs, Micro fabrication Industries, Diagnostic laboratories and startup companies with the theme of Lab on chip technology development.
Solar Based Water Purification

Patent Filed

Indian Patent Application No: 2894/DEL/2013

Inventors:
Mr. Ankit Anand
Mr. Arihant Bhandari
Mr. Shivam Prakash
Mr. Manoj Sharma
Dr. K Muralidhar

Department of Mechanical Engineering

Dr. Raj Ganesh Pala

Department of Chemical Engineering

Water purification system using an enhanced solar still to provide potable water throughout the day from impure water

Key Features

- Fresnel lens to concentrate light in a solar still making it less sensitive to the position of the sun.
- The use of hydrophobic membranes to increase the evaporation rate.
- Air pumps to convey water vapor into reservoirs and avoid inclining the condensing wall.
- Solar photovoltaic system to support peripherals and enable 24-hour operation.
- An overall buoyant device that can float on water and form a large-area network.
- Being solar based, operating costs are low as compared to reverse osmosis, UV radiation, and ultra-filtration.

Applications

- Treatment of waste water from tanneries, agriculture, and impure water from mines.
- Useful in dry barren areas with low population density.
- Will be attractive to the Navy and ISRO.
- Can be adopted under the corporate social responsibility programs of various companies

Cross-sectional view of the solar still

Contact: siic@iitk.ac.in
Surface Functionalization Unit

Patent Filed

Indian Patent Application No: 546/DEL/2013

Inventors:
Dr. Siddhartha Panda
Mr. Ramchander Chepyala

Department of Chemical Engineering

Surface preparation of substrates with different functional molecules to conduct many analytical techniques in applied chemistry, biology and so on.

Key Features

- Surface functionalization facility in an integrated compact unit instead of being separate units
- Enables large scale processing of sample sizes
- Complete surface functionalization of substrates (organic & inorganic) is carried out from cleaning to crosslinker stage in wet/dry form by spinning the substrates at required rotation to deposit uniform layers including rinsing steps

Applications

- Conducting analytical techniques in applied chemistry, biology, etc by both academia & industry
Computers and Electrical Engineering

Source: http://wallpapers.free-review.net/23__Windows__Electronic_Circuit.htm
A Low Complexity Symbol Timing Estimator for MIMO Modem Using two Samples per Symbol

Patent filed


Inventors:
Dr. Ajit K. Chaturvedi
Mr. Ketan Rajawat

Department of Electrical Engineering

*Telecommunication (High Data rate Wireless Communication)*

**Key Features**

- The patent aims at providing improved timing estimator and method for estimating accurate symbol timing for the decoding process with low implementation complexity usually present in the processes currently used in the industry.

- Symbol rate herein refers to the digital signals generated by transmitter in Digital Communications.

- The patent provides a symbol timing estimator that works with only two samples per symbol thus achieving a significant reduction on the computational and hardware complexity of Multiple-input-multiple-output (MIMO) systems.

**Applications**

- Mobile Wireless communications
- Telecom Companies involved in the Design and development of mobile phones, especially cellular or short range wireless communication systems
**Wide Band Loop Antenna**

**Patent Filed**

**Indian Patent Application No:**
1594/DEL/2006

**Inventors:**
Dr. A. R. Harish
Mr. Ravi Kr. Joshi

**Department of Electrical Engineering**

*Wide band antennas, having bandwidth of about 50% to 75% of the center frequency of the antenna, are disclosed*

**Key Features**

- A wideband antenna includes a conducting plate with a hole in it. The plate and the hole are characterized by first and second lengths which are the lengths of longest lines that can be drawn in the plate and the hole respectively.

- The first length bears a first predetermined ratio with the wavelength corresponding to the centre frequency. The second length of the hole bears a second predetermined ratio with the first length.

- The presence of the hole results in a non uniform cross section of the plate. The conducting plate has a slit that extends from an edge of the hole to an edge of the plate. A balanced feed line is connected to the slit edges.

**Applications**

- The proposed antenna was targeted for RFID and WLAN applications. However, the frequency scalability of the antenna does not limit the potential applications to these two only.

*Wideband loop antenna with tapered gap*
Soundcape Generation

Patent Filed

Indian Patent Application No:
2642/DEL/2010

Inventors:
Dr. Bharat Lohani
Mr. Susham Biswas

Department of Civil Engineering

Technology to provide a layer of audio information over the image/map servers, e.g., Google Earth, using available audio files, so a user while viewing image/map information can also hear the sound specific to any location

Key Features

- Current image/map servers only provide visual information with few audio files which can be heard on playing these

- Unlike visual information the audio information is discreet, depending on the place where an audio file is uploaded

- More audio file are being uploaded as people like to hear the sound of a place

- It computes the sound reaching at any and every location of terrain on map/image server using the sound files uploaded in the surrounding

- Provides continuous audio experience of the terrain as user moves over the image/map server

Applications

- Invention will lead to providing a continuous layer of sound over image/map servers

- Applications in tourism, planning and impact assessment
**Signal Detection System**

Patent Filed

Indian Patent Application No: 1617/DEL/2010

Inventors:
Dr. Sanjay G Dhande
Mr. Brij Mohan Shukla

*Department of Computer Science and Engineering*

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**System that facilitates transmission or broadcasting various media and information for automated control**

**Key Features**

- The invention enables communication between one or more slave nodes (passive or controlled devices) and master node (active or controlling devices) by configuring the slave node to identify the master from among several masters in a location, once slave node identifies a master it is associated till the given task is over.

- The automation or control is achieved that lowers risks associated with human interventions.

- The invention proposes a model that can be customized depending upon specific applications.

- The communication methodology can be used to choose parameters that can be controlled to achieve the desired objective.

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**Applications**

- Transportation and Railways
- Companies providing services/products to railways, mining companies, fleet owners

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**Coach Display Working**
Safety System for Vehicles

Patent Filed

Indian Patent Application No: 589/DEL/2011

Inventors:
Dr. Sanjay G Dhaned
Mr. Brij Mohan Shukla

Department of Computer Science and Engineering

An automated safety mechanism for trains and prevents the train collisions

Key Features

- The invention comprises of a train device and station device that facilitates track identification through a unique track Identification scheme for all tracks given in a geographical area, this track ID is unique and is achieved by series of RFID tracks embedded on the track

- As soon as the system senses another train on the same track it sends an alarm and the wireless brakes are actuated in real time on all wagons and thus brakes are applied simultaneously that is safer and also reduces the wear, tear and failure associated with currently used systems

Applications

- Transportation and Railways
- Companies providing services/products to railways, mining companies, fleet owners

Fig. 1
Vehicle Safety System
Optical Enhancement of Two-Photon Absorption Process

Patent Filed

Indian Patent Application No: 704/DEL/2008

Inventors:
Dr. Debabrata Goswami
Mr. Sumit Ashtekar
Mr. Amit Nag

Department of Chemistry

Method of enhancing two-photon absorption cross-section irrespective of molecular characteristics by simply changing the phase-ordering within a laser pulse

Key Features

- The method includes
  - Providing a substrate having a two photon absorption property
  - Providing a laser source capable of emitting femtosecond laser pulses
  - Linearly chirping the laser pulses and characterising the linearly chirped laser pulse

- Subsequently a substrate having two-photon absorption properties is excited with this linearly chirped pulse in a controlled manner to achieve an optimum enhancement of the two-photon absorption of the substrate

Applications

- Two-photon imaging
- Optical limiting
- Two photon photodynamic therapy etc
Method, System and Device for Enhancing Flow Field Data

Patent Filed

Indian Patent Application No:
797/DEL/2011

PCT filing No.
PCT/EP2008/061078

Inventors:
Dr. K Muralidhar
Department of Mechanical Engineering

Dr. Mcgregor Robert
Dr. Szczerba Dominik
Dr. Szekely Gabor,

Joint applicant:
ETH Zurich, Switzerland

Flow simulation and analysis in fluid systems for generating high-resolution flow field data from sparse measurement data

Key Features

- CFD is used in conjunction with medical imaging so as to obtain highly resolved time-dependent flow fields
- Generation of high resolution flow field data which can produce quick results and can be used for all diagnostic information
- The invention gives access to wealth of data, not only of velocity but also pressure distributions as well as secondary flow properties, such as WSS

Applications

- Biomedical diagnosis e.g. obtaining high resolution patient-specific abdominal aortic flow fields from PC-MRI data
A Process for Compression of Surveillance Video Data for Long Storage in Smaller Storage Medium

Patent Filed


Inventors:
Dr. K S Venkatesh
Mr. Durga Prasad Kethineedi

Department of Electrical Engineering

Multilayered background models of static camera data for summarization, compression and 2.5D analysis

Key Features

- The aim of surveillance video summarization is to automatically identify high-value information events in a video stream and to present them to user
- Video information is invariably extremely heavy and hence time consuming to view and summarize as well as space consuming to store
- By extracting the foreground objects in static camera video, we develop a method by which the entire video can be viewed in much lesser time without losing a feel of continuity
- Improved video compression algorithm, which eliminates the redundancy in the frames before processing through any standard video encoder and hence reducing the enormous storage space required for raw video
- It also includes 2.5D analysis of the static camera video with the help of the extracted stationary foreground objects and processing these objects with different morphological operations

Applications

- For long video data storage in smaller storage medium
**Vein Visualization Device**

Patent Filed

Indian Patent Application No: 1525/DEL/2012

Inventors:
Dr. Harshwardhan Wanare
Ms. Neha Singh
Department of Physics

Dr. K. K. Dokania
( *Pediatrician, Shyam Children & Maternity Center, Kanpur*)

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*The device provides real-time visual contrast to veins hidden in the tissue for administering intravenous injections, without any external aids*

**Key Features**

- Provides visual contrast by incorporating the response of blood in the vein as well as the visual colour sensitivity
- It uses light source peaking at 575 nm, that matches with an absorption peak of blood in the veins
- The spectral content helps enhance visual sensitivity as it aids both photopic and scotopic response
- First and only device in the world that optimises both the blood response as well as the visual sensitivity

---

**Applications**

- A tool to increase delivery of intravenous injections in in adults, children and infants
- Reduces pain and trauma by reducing the number of attempts required to give an intravenous injection
- Easy to use and safe tool for all health care providers
- Can be a life-saving tool in cases of neonatal and senior citizens involving either a very fine vein or in cases of vein collapse

---

Contact: siic@iitk.ac.in
A Method and System for Human Gesture based on Visual Contour Analysis

Patent Filed

Indian Patent Application No: 974/DEL/2010

Inventors:
Dr. K. S. Venkatesh
Ms. Armin Mustafa

Department of Electrical Engineering

**Background reflectance modelling for robust finger gesture detection in highly dynamic illumination**

**Key Features**

- An aim to develop accessory-free interface for communication and computation without requirement of any specified gadgets such as finger markers, coloured gloves, wrist band or touch screen

- Various types of gestures can be detected by finding fingertip point locations in a dynamic changing foreground projection with varying illumination on an arbitrary background using visual segmentation by reflectance modelling

- It has been termed dynamic illumination environment as the projected light is liable to change continuously both in time and space and also varies with the content displayed on coloured or white surface

**Applications**

- It facilitates an accessory-free interface for communication and computation without requirement of any specified gadgets such as finger markers, coloured gloves, wrist band or touch screen

*Multi-touch sensing through frustrated total internal reflection*

Contact: siic@iitk.ac.in
A System and Method for Electronic Retail Banking

Patent Filed

Indian Patent Application No: 1629/DEL./2010

Inventors:
Dr. Sanjay G. Dhande
Dr. Nachiketa Tiwari
Ms. Joshima V. M.

Master of Design Programme

A system and method for providing the users a secure service relating to deposit withdrawal and transfer of processed data including financial instruments

Key Features

- Developing a much simpler process for large number of transactions
- In device e-form which requires minimal entry of personal data, as bulk of that data is retrieved from ATM card. And also its ability to print transaction details in bar code as well as alpha numeric format
- In device e-reader, which reads printout of e-form, through a bar-code scanner and verifies the accuracy of transaction almost immediately by remaining connected with local bank networks
- The Retail banking transaction process is made much faster and efficient

Applications

- Retail Banking Industry
A System and Method for Transmitting Mails from a First Location to a Second Location

Patent Filed

Indian Patent Application No: 3100/DEL/2010

Inventors:
Dr. Sanjay G. Dhanpe
Dr. Nachiketa Tiwari
Ms. Joshima V. M.

Master of Design Programme

A system and method for secure and fast mail transmission from first location to a second location

Key Features

- The devices are enabled to transmit/receive data including textual and digital data, and being interconnected via respective wireless devices to a satellite network

- Each of the devices comprises a scanner, a bar code reader or a magnetic strip reader, a memory to store data, a display screen, a printer, a power unit, an audio recorder and software means incorporating instructions

- Each of the device is enabled to operate in a transaction mode and/or a reception mode

- Cost effective, reduction in transit time of the mails, fast, secure and easy to operate

Applications

- Transfer of financial Instruments
- Transmission of colour data and images
- Export of technologies, products, and processes. etc

Contact: siic@iitk.ac.in
Improved Single Phase Phase-Locked Loop

Patent Filed


Inventors:
Dr. P. S. Sensarma
Mr. Rakesh Kr. Sinha

Department of Electrical Engineering

A single-phase PLL is described which is capable of fast phase locking to line voltages and currents in the utility grid in presence of severe distortion, sensor offset and measurement.

Key Features

- A chain of pre-filters and signal conditioning before an SRF-PLL.
- Synthesizing a signal orthogonal to the fundamental component of the measured quantity.
- Using the main and orthogonal signals, the chain of pre-filters sequentially removes harmonics, noise, negative and zero-sequence components before calibrated adjustment for phase delay in the pre-filter chain.
- The SRF-PLL works with an orthogonal pair of signals at the fundamental line frequency to ensure accurate phase-lock.

Applications

- Single-phase energy meters
- Single-phase harmonic analyzers
- Single-phase STACOM, DVR, UPQC and other custom power devices for reference frame generation.

PLL performance with distorted input.
(1)Input signal (2) in-phase unit vector
A converter-control arrangement with a buck converter which ensures arbitrary power evacuation, limited by maximum capacity, from individual dc voltage sources connected in a series string

**Key Features**

- A bi-directional power electronic interface module between the dc voltage source and the common wire connecting the dc voltage sources in series.

- External load/sink is presented with a series connection of the output terminals of these interface modules.

- Relative duration of conduction of each switch (source and load sides) decide the evacuated energy from the source.

- A simple control is capable of ensuring arbitrary energy evacuation, subject to maximum capacity of the source and load, whichever is lower.

**Applications**

- Series connection of dc power supplies to obtain high voltage dc.

- Series connection of batteries allowing both controlled charging and discharging of each battery in the string at a rate commensurate with the health and SOC of that individual battery.

*Fig. 1. Battery currents and output current*

*Fig. 2. Individual interface output voltages and total output voltage*
**An Organic/Polymer low Information Content Displays**

**Patent Filed**

**Indian Patent Application No:** 1525/DEL./2006

**Inventors:**
Dr. Raghubir Singh Anand
Dr. Anjali Giri
Mr. Ramesh Prasad

**Department of Electrical Engineering**

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**Invention of low information content displays like 7-segments using organic materials**

**Key Features**

- Technology of low information content displays using Polymer and small molecules Organic Light emitting materials has been developed.

- These digital displays are usually made by modifying the anode layer by metal evaporation, photolithography and etching of wanted materials.

- The use of the type of configured metal mask will much simplifies the process of digital displays fabrication as it will eliminate the previous mentioned processes.

- The technology can be used for 7-segment, 14-segment, 16-segment and dot matrix displays.

**Applications**

- General signboard displays, audio/video systems, measurement equipments, digital watches and many home appliances.

---

*Display using Polymer and small molecules Organic Light emitting materials*
Using Personal Devices for Authentication and Service Access at Service Outlets

Patent Filed

Indian Patent Application No: 1018/DEL/2008

Inventors:
Dr. Rajat Moona
Mr. Abhishek Gaurav
Mr. Ankit Sharma
Mr. Vikas Gelara

Department of Computer Science and Engineering

A system where a personal device of the user is used for authentication and secure communication with the service provider's equipment for an access to the services

Key Features

- A ubiquitous computing device has been used to authenticate and access control to a service
- A method of authentication suitable to scenarios involving service-dispensing outlets or access control after authentication has been proposed
- The use of a security device such as SIM has been proposed, which is more secure than the presently used security device, magnetic stripe cards
- An offline trusts based security model is proposed with the user owned ubiquitous device

Applications

- Bank ATM services, petrol pump etc
**Power Supply System**

**Patent Filed**

**Indian Patent Application No:**
1053/DEL/2011

**Inventor:**
Dr. Santanu K. Mishra

**Department of Electrical Engineering**

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*AC to DC power supply for telecom exchanges is designed which works with one-two-or three phase input without any manual or automatic phase changer. There is also no de-rating of output power as the number of input phase changes.*

---

**Key Features**

- The plant works with either one, two, or three phases as per availability, and produces a 48 VDC output. The use of a four leg diode bridge to achieve this objective is a part of the novelty.

- Special control algorithms are embedded in the control architecture to achieve this wide input range of voltage variation.

- Appropriate control algorithm is incorporated in the design to avoid chattering of the converter if the input voltage persists at the pass-through limit.

---

**Applications**

- Any isolated AC-DC power supply where the input AC comes from an unreliable three phase grid.

- Telecom power plant was the targeted application in this case. However, the idea is applicable to any three phase AC to DC rectifier with an unreliable AC input.

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[Images showing waveforms: 3 phase to DC, 2 phase to DC, 1 phase to DC]
**A Lithography Based Two Stage Reservoir in an Electrolyte Insulator Semiconductor Device**

**Patent Filed**

Indian Patent Application No: 219/DEL/2010

Inventors:  
Dr. Siddhartha Panda  
Mr. Abhishek Agarwal

**Department of Chemical Engineering**

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**Method for large scale manufacturing of single devices as well as arrays of sensors of application specific designs**

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**Key Features**

- The double lithographic technique, using photoresist as the material, is used to create a “two step” reservoir in a non-flow EIS device
- The two step design – this design provides a better protection of the dielectric layer from the vapor deposited metal electrode
- This enables a reliable fabrication of the electrode which is the critical component
- The process fits into the semiconductor manufacturability processing scheme
- The design enables miniaturization

---

**Applications**

- The device is a miniaturized pH meter capable of handling small volumes (~ microliters)
- It has applications in companies that need analytical testing/detection: Pharmaceutical/biomedical, Chemical Process, Food/Beverage and Environmental Testing companies
A Power Supply System for Electronic Devices

An uninterrupted power supply system for computers, televisions and medical equipments

Key Features

- Provides a cost effective and compact power supply system with very good back-up time
- The system comprises of an AC voltage source, AC to DC convertor, DC Voltage storage, a secondary conversion circuit for providing regulated DC voltages and a feedback controller connected across the second conversion circuit for regulating DC voltages for electronic devices
- Power supply system has zero switch over time
- The circuitry and hardware content is simplified

Applications

- Household usages in appliances
Remote Service Machine (RSM)

An automated system capable of providing consumer-based services like gas delivery service, health care services etc

Key Features

- Remote Service Machine uses RFID technology
- The Remote Service Machine is also suited for providing emergency services like police and fire fighting assistance to rural masses with no internet access or knowledge of computers
- System is ideally suited for improving accountability in Indian scenario

Applications

- Consumer-based services like gas delivery, health care, attendance monitoring, ticket booking, on-line stock exchange services, emergency services like seeking police and fire fighting assistance in rural areas

Remote Service Machine (RSM)
Transfer of Power to Contact-Less Smart Cards with Light from the Reader

The energy for the RF contactless smartcard reader is provided by an optical source in the reader

Key Features

- The optical source on the reader activated by bringing the smart card near it
- Optical source from reader will transfer power to the photovoltaic chips on the smart card during smart card usage such as identity verification, registering usage, activating sensors and the like

Applications

- RF power may be limited to only communication applications and not for computation within the smart card
- With higher power availability from the optical source, more sophisticated functionality may be built into the smart card
- The contact-less transfer of power makes the smart card operation more robust
Multiple threshold voltage metal oxide semiconductor field effect transistor (MOSFET) devices can be fabricated by varying the selective buried oxide opening under the body of the transistor at an early stage of the processing with no requirement of extra processing time.

Key Features

- For the same processing parameters of implant dose and thermal processes, the threshold voltage of a bulk silicon MOSFET and silicon on insulator (SOI) MOSFET are different

- The threshold voltage of the selective BOX is a function of the opening size in the BOX

- The threshold voltage of MOSFET fabricated with openings in the buried oxide (BOX) will lie between those for bulk silicon and SOI MOSFETs

Applications

- Building circuits requiring multiple threshold transistors with SELBOX processing technology
- Gives design flexibility to circuit designers
- Low power dissipation parts of the circuits can use high threshold voltage transistors
- High speed parts of the circuit may be designed with low threshold voltage transistors

The spacing between the SELBOX can be tuned to choose the threshold of the MOSFET fabricated.
Three imidazolin-5-ones and their analogue molecules were synthesized and used for photovoltaic and photo-detector application

Key Features

- Three new molecules in the imidazolin-5-one family were synthesized
- Organic solar cells with the structure Anode/PEDOT:PSS/Imidazolin-5-one (s) Active layer/Cathode can be fabricated
- Imidazolin-5-one molecules are more environmentally benign

Applications

- For building organic solar cells
- The devices may also be used as a photodetector, especially for the peak-absorption frequencies of the molecules used to fabricate the active layer

Molecule A

Molecule B

Molecule C

Contact: siic@iitk.ac.in
Manufacturing of Organic Photovoltaic Device

Patent Filed


Inventors:
Dr. S. S. K. Iyer
Mr. Anirban Bagui

Department of Electrical Engineering and Physics

Annealing of the active layer during its formation by the solvent drying step in the presence of electric field is able to enhance efficiency of the bulk-heterojunction based polymer solar cells

Key Features

- The active layer in polymer based organic solar cells are formed by wet processing where the solvent is removed by annealing after coating a solution of the active layer
- An application of an electric field during the solvent drying step significantly improves the performance of the subsequent solar cells fabricated with those layers

Applications

- Fabrication of higher efficiency polymer based solar cells
- No extra process time needed to incorporate this annealing step in regular bulk-heterojunction solar cell fabrication
- Negligible energy consumed in incorporating this inventive step during regular device process

Schematic organic solar cells
**Method of Fabricating Organic Thin Film and Organic Thin Film thereof**

**Patent Filed**

**Indian Patent Application No:**
1585/DEI./2011

**Inventors:**
Dr. S. S. K. Iyer
Mr. Anukul Prasad Parhi
Dr. Satyendra Kumar

**Department of Electrical Engineering**

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**Improved crystallinity and formation of columnar structure in copper phthalocyanine (CuPc) films at lower temperature annealing is achieved by annealing them in the presence of an electric field.**

**Key Features**

- The crystallinity may be increased and nano column formation on the CuPc film can be hastened by annealing (1500 to 200°C) it in the presence of an electric field.

- Higher crystallinity achieved at lower temperature finds application in many electronic and optoelectronic device fabrication with CuPc films.

- Improved organic solar cells may be fabricated with the electric field annealed CuPc films.

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**Applications**

- Columnar structures formed on CuPc films can help interdigital heterojunction fabrication that are desirable for many device fabrication, including organic solar cells.

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Contact: siic@iitk.ac.in
**Magnesium Inserted Porphyrin Compound, its Blends and Devices thereof**

Patent Filed


Inventors:
Dr. S. S. K. Iyer  
Mr. Arvind Singh  
Mr. S. K. Asif Iqbal  
Dr. S. P. Rath

*Department of Electrical Engineering and Chemistry*

New molecules of magnesium inserted porphyrin compounds have been synthesized and solar cells fabricated from them show photovoltaic responses

**Key Features**

- Three magnesium inserted porphyrin molecules whose structures are shown above were fabricated

- Organic solar cells fabricated with these molecules as well as blends of these molecules with known acceptor compounds have shown photovoltaic effect

**Applications**

- The molecules can find application in building organic solar cells

- Photodetectors of specific wavelength of detection may be fabricated from these molecules

(a) Bis-Mg porphyrin  
(b) Mg (tetra nitro octa ethyl porphyrin) 4,4'bipyridine and  
(c) Mg (tetra nitro octa ethyl porphyrin)
An Improved Lateral Bipolar Junction Transistor (BJT) on selective Buried Oxide (selbox) and a Method for Manufacturing the same

Patent Filed

Indian Patent Application No: 1478/DEL/2008

Inventors:
Dr. S. S. K. Iyer
Dr. S. Qureshi
Mr. Sajad A. Lone

Department of Electrical Engineering

Achieving improved device performance parameters in lateral BJT devices by choosing appropriate size and edge location of buried oxide under emitter and base of the transistor

Key Features

- The lateral BJT performance parameters may be tuned by introducing SELBOX under the emitter and base
- By appropriate choice of the size of SELBOX, higher current gain and gain-bandwidth product can be obtained

Applications

- Improved performance BJTs for high power applications
- Improved performance BJTs in mixed signal ICs

![Diagram of Lateral n^-p-n BJT with a SELBOX underneath it. The device parameters vary with SELBOX size.](image)

Contact: siic@iitk.ac.in
A computing mechanism and machine has been developed, dependant on predetermined requirements of refractive indices \( (n_i) \) or absorption coefficients \( (\alpha) \) of intermixed III-V compound semiconductor quantum wells, for the control of the RTA process.

**Key Features**

- A generic computing mechanism has been developed to control the rapid thermal anneal (RTA) process depending on predetermined requirement of refractive indices \( (n_i) \) or absorption coefficients \( (\alpha) \) of a wide range of intermixed III-V compound semiconductor quantum wells.

- The user will have to provide the material parameters and the RTA system parameters to the computing machine and the generic system will perform the required computation to control the RTA system for achieving a predetermined refractive indices \( (n_i) \) and absorption coefficients \( (\alpha) \) of the intermixed MQW structure.

**Applications**

- In optoelectronic devices design and fabrication.
- Development of automation software which will help to control the operation of rapid Thermal Processor for MQW intermixing.
Switches for wavelength division multiplexing (WDM) system in fiber optics networks

Key Features

- This invention provides architecture for rearrangeby non-blocking all-optical cross connect wavelength division multiplexing switching system.
- Reduction in the losses and dynamic range incurred by the channels passing through the cross connection.
- Reduction in the probability of arrangement.
- Elimination of the tuning requirement.

Applications

- Telecommunications technology
- Fiber Optics Networks
WDM Optical Packet Switch incorporating Fiber Bragg Gratings and Circulator

Patent Filed


Inventors:
Dr. Y. N. Singh
Mr. Rajiv Srivastava
Mr. Rajat Kumar Singh

Department of Electrical Engineering

Design of a broadcast and select type optical packet switches, which incorporate Fiber Bragg Grating (FBG) and circulator in optical packet switch

Key Features

- A novel configuration of reflectors, circulator and AWG, and pieces of fiber to achieve the desired switching feature

- High-throughput networks required for communication of voice, images, and other data, is achieved

- The performance of the switch is enhanced by reducing power dissipation, output conflict resolution and congestion alleviation

- The performance of the switch is improved by using only two components, i.e., FBG and circulator, in the buffer strategy

Applications

- Telecom Switch manufacturing

Contact: siic@iitk.ac.in
All Optical Reflectors based WDM Optical Packet Switch

Patent Filed


Inventors:
Dr. Y. N. Singh
Mr. Rajiv Srivastava
Mr. Rajat Kumar Singh

Department of Electrical Engineering

A novel design of wavelength division multiplexing optical packet switch, for optical packet switch architecture

Key Features

- A novel design of optical packet switch architecture is proposed that can have two different buffering strategies
- In the first strategy an optical reflector is used in each buffer module while in the second, only the fiber pieces are used in each buffer module
- Loop buffer module with the self wavelength routing nature of the AWG gives rise to novel optical packet switch architecture
- High throughput networks and high efficiency of optical packet switch is achieved

Applications

- In the areas of high throughput networks for communication of voice, video, images, and data
**Dielectric Resonator**

Patent Filed

**Indian Patent Application No:** 1972/DEL/2004

**US Patent Application No:** 11/248, 023

**Inventors:**
Dr. Animesh Biswas  
Mr. Kumar Vaibhav Srivastava  
Mr. Vishwa V. Mishra

**Department of Electrical Engineering**

*Improved dielectric resonators wherein the spurious frequency modes are highly subdued.*

**Key Features**

- The modified ring DR provides a design for a dielectric resonator which provides 6% in absolute terms and 12-15% in comparative values improved mode separation as compared with the conventional devices.

- The modified ring DR shows no deterioration Q-factor of fundamental mode as compared to a conventional ring DR in MIC environment.

- The filling factor of the interfering modes does not influence the modified ring resonator for various thickness of the substrate.

- The modified ring DR exhibits much lower degradation of mode separation than the conventional ring resonator while tuning.

- The modified ring DR offers versatility in choosing the substrate thickness.

**Applications**

- Communication electronics, specially in microwave telecom systems for satellite telecom as well as terrestrial links and cellular mobile handsets.

(a) Modified Ring DR Filter  
(b) Modified Ring DR
A Dynamic Logic Family using only N or P-type Enhancement Mode-MOSFET

Patent Filed


Inventors:
Mr. Ashish Kumar Agarwal
Mr. Anil Bawa
Dr. Baquer Mazhari

Department of Electrical Engineering

A digital logic family implemented entirely with either NMOS or PMOS enhancement mode transistors to simplify logic design

Key Features

- A dynamic logic family with only N-type or P-type enhancement mode MOSFET.
- Better layout compactness
- Lower delay
- Lower leakage current

Applications

- Any CMOS digital integrated circuit design/manufacturer company

Contact: siic@iitk.ac.in
This invention relates to a Split Table ATM Multicast Switch (S-TAMB)

Key Features

- The split Table ATM multicast switch (S-TAMS) for use in the series characterized in that an input cells processor being connected to a running adder and dummy address encoder adapted to be connected to a combactor, a replicating banyan network being connected to the outputs of said combactor, the outputs of said replicating banyan being connected to a routing network having output buffer being connected therewith

- Split Table ATM multicast switch having the means to reduces memory network but function efficiently

- It obviates the table duplication problem

Applications

- Video-conferencing video-on-demand multiparty telephony, distributed computing, video-distribution and broadcasting and tele-teaching

- Banking and IT & ITES, E-governance companies
Flight Planning for Airborne Data Acquisition

Flight Planning for Airborne Data Acquisition Using Genetic and Evolutionary Algorithms: LiDAR and Photographic Data

Key Features

- A generic flight planning system and methodology that can consider variations in the number and characteristics of the flight planning elements by minimizing the total air time (or flight duration) for airborne data acquisition by considering the strip time, turning time and restricting the propagated errors

- The variation in data requirements caused by the terrain change are also addressed and minimum specifications are guaranteed

- The derived parameters ensure data quality, mapping standards, project specifications and user requirements simultaneously.

Applications

- Airborne land survey & GIS Mapping using airborne LiDAR

Contact: siic@iitk.ac.in
**Analog Maximum Power Point Tracker for Solar Photovoltaic**

**Patent Filed**

**Indian Patent Application No:** 918/DEL/2013

**Inventors:**
Dr. Parthasarathi Sensarma
Mr. Soumya Shubra Nag

**Department of Electrical Engineering**

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**Controlling method of an inter-connected utility system based on photovoltaic sources, which is implemented through analog electronics**

**Key Features**

- The Control apparatus is used for tracking a maximum power point (MPP) for a solar photovoltaic panel.
- Control apparatus is based on-line computation of maximum terminal voltage ($V_{pmax}$) of the SPV panel.
- It has an insignificant perturbation in the SPV-panel voltage is applied and change in power is tracked.
- An analog MPPT controller which attains MPP without using multiplier and storage elements.
- The proposed controller operates under the principle of Voltage perturbation.

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**Applications**

- Energy productivity
- Power tracking solar power system

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Contact: siic@iitk.ac.in

IIT Kanpur Technologies | 37
Pentacene Deposition in Organic Thin Film Transistors

Patent Filed

Indian Patent Application No: 1615/DEL/2013

Inventors:
Deepak Gupta
Dr. Ashish Garg
Mr. Tapendu Mandal

Department of Material Science Engineering

A method for improving mobility of a pentacene based organic thin-film transistor by field assisted deposition

Key Features

- Process yields a pentacene thin-film transistor with higher carrier mobility, high $I_{dsat}$, and lower gate leakage in comparison to standard process.

- Process is simpler and has fewer process steps than the conventional fabrication process.

- Post- deposition anneal step not needed.

- Effect of electric field during deposition is more than the effect of dielectric surface treatment with OTS. Treating the surface of the dielectric material by Octadecyltrichlorosilane (OTS) and similar other chemicals reduces the process conditions sensitivities.

Applications

- Industry engaged in fabrication of OTFTs
Non-invasive and Non-Destructive Coplanar Microwave Sensor for Dielectric Measurement of Liquids and Granular Materials at RF and microwave frequencies

Key Features

- The test specimen is filled into a disposable container beforehand thus avoiding any direct contact between the sample and the designed sensor or the electronic circuitry.

- Requires the measurement of the reflection and transmission coefficients using a vector network analyzer by connecting the sensor loaded with the test specimen between two ports of the analyzer through appropriate transitions.

- The dielectric properties of the test specimen are determined in terms of the measured reflection and transmission coefficients using standard mathematical algorithms.

Applications

- Suited for viscous liquids such as resins, whose dielectric properties are important for microwave heating and material processing applications.

- In Agricultural and food industry for finding adulteration & contamination for products such as oil, milk etc.

- In the biomedical field, for testing of blood samples.
Natural daylight color visualization for NIR multispectral (700-1100 nm) imagery

Key Features

- Capacity to provide near natural colour images, using multichannel NIR data, even in the complete absence of light in the visible band.

- To distinguish objects on the basis of their different visible band responses.

- Image segmentation of the multichannel NIR data followed by piecewise separate transformations applied to different segments yields the desired results.

- The individual colour transformations are initially learned one-time using manually selected inputs.

Applications

- Huge potential in surveillance, reconnaissance, and security applications.

- Defence, paramilitary and State police personnel.

Figure (a) Day light color image of a plant, (b) NIR night time images of the same scene at 750nm wavelength (c) NIR night time images of the same scene at 850nm wavelength (d) NIR night time images of the same scene at 950nm wavelength (e) NIR color image after applying algorithm.
Signature Verification by using Stereo Camera and Tablet

Key Features

- Improving the biometric verification method by employing the 3rd dimension in signature verification
- Can distinguish between the genuine user and fraud users more accurately
- Employing the 3rd dimension of the signature
- Adding pressure from the tablet and trajectories of pen tip from the stereo camera, which makes signature 3D

Applications

- In the areas of Defence, Banks, Educational institutes so on, where person's identification is critical.

Figure: Pen tip detection. Red window shows search range in which pen tip can be found by using template matching. Green window is the result of template matching and pen tip lies at the center.
Real Time Image Stabilization

Patent Filed

Indian Patent Application No: 2041/DEL/2013

Inventors:
Mr. Bhoopendra Singh
Dr. K S Venkatesh

Department of Electrical Engineering

Real time digital image stabilization using bit plane integral projection

Key Features

- Real time implementation ability.
- Uses integral projection on a gray coded bit plane of an image to computed motion parameters.
- Reduces hardware requirements significantly for computing horizontal and vertical motion vector components of the camera
- It decomposes a gray scale image frame into a plurality of bit planes
- The motion parameters are identified based on the plurality of bit planes

Applications

- Potential in surveillance, reconnaissance and security applications
- Industrial application in defence productions, paramilitary and State police personnel.

Figure showing: (a) Latent image (b) Motion blurred image (c) Motion deblurred image (d) Denoised motion deblurred image

Contact: siic@iitk.ac.in
**A Method and System for Generating Correct 3D Geometry of Moving Object using Laser Scanning**

*This invention makes it possible to develop 3D models through laser scanning of moving objects, thus eliminating the limitation of conventional laser scanning which demands the objects to be stationary.*

**Key Features**

- The laser scanner coordinates are first georeferenced in global coordinate system.
- The trajectory of the moving object is observed using a POS system kept on the object.
- The laser scanner coordinates are integrated with the moving object trajectory after time synchronization between these.
- A method uses the above and applies correction to laser scanner coordinates to bring them back to a relative coordinate system which is equivalent to eliminating the motion distortion.

**Applications**

- 3D modelling of large ships which cannot be kept stationary
- Ship damage assessment while ship is moving
- Experimental laser cross-section determination of ships
- 3D as-built modelling of large aerostat balloons
- 3D as-built modelling of large air-balloons

**Patent Filed**

*Indian Patent Application No: 638/DEL/2013*

**Inventors:**
Dr. Bharat Lohani  
Mr. Salil Goel

*Department of Civil Engineering*

Mr. Ragavendra Natarajan

*Joint patent with DRDO*
RFID Tags

Patent Filed

Indian Patent Application No: 1467/DEL/2013

Inventors:
Dr. A R Harish
Mr. Akshay Jain

Department of Electrical Engineering

Performance enhancement of RFID tags on conductive grids by introducing minor modifications in the conductive grid, but without changing either the tag design or introducing spacer between the grid surface and the tag.

Key Features

- Local modifications are introduced to create high impedance region and hence the tangential component of electric field on the surface is enhanced.

- This enhances the performance of an RFID tag placed in that region.

- Very attractive in situations where the modifications can be incorporated into the product at the design stage.

- No additional cost to the product, since the proposed idea does not require the use of additional spacers or modifications to the tag.

Applications

- RFID tagging of chassis of the appliance, heat sink, protective skin, shielding, outer body, thermal vents or air vents, inspection vents etc.

- Can also be used to tag composite structures made of conducting strands, e.g., carbon composites, textile with conductive strands, insulating material with conductive surface treatment, and glass with metal reinforcement, e.g., vehicle windscreen, inspection window, etc.

RFID tag on a conducting grid
Direct usage of vegetable oils in diesel engines

Key Features

- This design enables utilization of waste exhaust heat to precondition the vegetable oil by raising its temperature to a level, where the physical properties of vegetable oils comes within a very narrow band of that of petroleum diesel fuel at room temperature.

- This system enables effective utilization of straight vegetable oils without the problems such as injector coking, poor atomization, ring sticking and cylinder deposits etc.

- There is no additional cost associated such as fuel processing cost, cost of additive, cost of electricity etc.

Applications

- Engines used in agriculture, gen-sets, farm-machinery etc.

Contact: siic@iitk.ac.in
Conversion of Vegetable Oils to Biodiesel

Patent Filed


Inventor: Dr. Avinash Kumar Agarwal

Department of Mechanical Engineering

The biodiesel plant is designed and developed with suitability for rural areas application, where biodiesel can be manufactured on-site for utilization, enabling major cost cutting.

Key Features

- The plant is capable to produce biodiesel from different types of edible and non-edible vegetable oils and animal fats
- The design yields very good quantities of ASTM grade bio-diesel
- The design enable smooth operation even in case of any blockage of any line / vessel pipeline
- Wastage of raw material is minimal and the by-products can be segregated separately

Applications

- Biodiesel production for rural areas
- Petroleum companies

Picture of the experimental Set-up of biodiesel plant
A Green Harvesting Device for Low Power Electronic Equipment

Designing of a device which charges the gadgets like mobile phone, iPod, cameras etc when a person is away from conventional electricity source as in travelling, on adventure outings outdoor camping etc.

Key Features

- Concept was eventually finalized to gain power from three alternate renewable non-depleting energy sources: wind, solar and vibration.
- The device consists of three modes of energy transformation, a solar cell to convert solar energy to electricity, a micro-turbine to convert wind energy to electricity and piezoelectric device to convert vibration energy to electricity.
- It has compact size, flexible solar panel and cover over turbine fan protects it from dust when device is not in use.
- Ergonomic shock resistance, easy reparable, physical form and aesthetics portable and easy to use.

Applications

- For charging gadgets like mobile phone, iPod, cameras from non-conventional energy sources.

Contact: siic@iitk.ac.in
This recuperative burner is designed and developed to recuperate the exhaust heat to enhance its efficiency burner with low emission level that can be used for industrial applications.

**Key Features**

- A novel recuperative vortex LPG burner has been designed and developed indigenously in our laboratory based on concept of asymmetric vortex combustion.
- Swirl is imparted to air to stabilize the flame over a wide range of operating condition.
- In this burner, fuel and air are introduced separately creating a partially premixed vortex flame in the burner.
- Flame stabilization particularly at high power level.

**Applications**

- The burner can be used combustor for running gas turbine engine, rocket engines heating, drying, etc.
- It can be used for other industries like, steel, coke, metal, glass making, pottery, etc.

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Contact: siic@iitk.ac.in
Low Emission Energy Efficient Gas Burner

Patent Filed


Inventor: Dr. D. P. Mishra

Department of Aerospace Engineering

An energy efficiency burner with low emission level that can be used for non-domestic applications

Key Features

- Based on the concept of whirling combustion by using tangential entry of fuel-air mixture
- A central port is provided to have secondary mixing for better combustion
- Methods to arrest the flash back
- Optimization of mixing system for fuel and air

Applications

- The burner can be used by all commercial cooking establishments like hotels, hostels, restaurants
- It can be used for process industries

Flame photograph of Low Emission Energy Efficient Burner

Contact: siic@iitk.ac.in
A Heat Recovering Microcombustor

Patent Filed


Inventors:
Dr. D. P. Mishra
Mr. S. Y. Jejurkar

Department of Aerospace Engineering

The microcombustor design proposes a thermal flame stabilization method for high momentum flows encountered in practice and based on thermal recycle by creating a thermally isolated zone within the microcombustor structure

Applications

- As a source of propulsive energy for micro air vehicles and microsatellites
- As a source of heat in thermoelectric and thermo photovoltaic energy converters for applications to consumer electronics and hand-held communication devices, etc.

Key Features

- Incorporates nitrogen containing inner core into the combustion zone to quickly store the heat liberated in the initial stages of flame stabilization when extinction of flame is most likely
- Shape factor of the proposed design is suitable for deployment in propulsion or electric power generation applications
- Materials (steel and ceramic) used commonly for building small-scale devices can be employed in the construction of this microcombustor

Depiction of thermal structure of a premixed hydrogen-air flame stabilized in the proposed annular micro combustor
A Device for Extracting Power from To-and-Fro-Wind

Patent Granted


Grant No: 212643

Inventors: Dr. Kunal Ghosh

Department of Aerospace Engineering

The wind turbine, which is currently used in Oscillating Water Column Wave Energy Device for extraction of power from ocean waves, stalls when high waves (more energetic) arrive and should be replaced by the present device that can cope with high waves without stalling.

Key Features

- The device is based on the principle that a cascade of airfoils can turn a stream through large angles without stalling.

- Two zero-stagger cascade of 5 or 6 symmetric airfoils are deployed on a core body to create a new turbine.

- The core body consists of a hemisphere, a cylinder and another hemisphere joined back to back to produce a long streamlined body that looks like an aircraft fuselage.

- An optimal gap-chord ratio has been specified for the cascade.
A Wind Turbine Device

Patent Filed

Indian Patent Application No: 570/DEL/2005

Inventor:
Dr. Kunal Ghosh

Department of Aerospace Engineering

The invention relates to a wind turbine device

Key Features

- A tube tower having a Vertical Axis Wind Turbine mounted on its top

- Guy wires for holding said tower through clamps to the ground characterized in that a flexible steel cable which passes through said tube tower for transmitting torque and mechanical power is connected between the vertical axis at the top of the tower and speed altering device provided at the bottom of said tower

- A generator or mechanical equipment is connected to said speed altering device for producing electrical or mechanical power

Applications

- Wind power generation
Device for Power Control and Storm Security for Savonius Wind Turbine

Patent Filed

Indian Patent Application No: 1217/DEL/2010

Inventor: Dr. Kunal Ghosh

Department of Aerospace Engineering

A device that can control power of the Savonius wind turbines in high wind situation such as storms and hurricanes, without compromising any of its advantages

Key Features

- The built-in device provides automatic power control and storm security.
- The device consists of a window on each cup of the turbine and a shutter that automatically Opens due to centrifugal force when the rpm of the turbine exceeds a threshold limit.
- The open shutter releases wind pressure and also offers aerodynamic braking and thereby limits rpm and controls power.
- The device is simple in use, inexpensive in construction, and extremely effective in turbine protection.

Applications

- Used for both electricity generation and developing mechanical power to drive positive displacement pump lifting water or a grinder crushing grain.
- The invention could be used by small wind turbine firms/Labs (<5kW) for power generation/water pumping/grain grinding.

(a) A schematic representation of Savonius vertical axis wind turbine.
(b) A photograph of Power Control Device with Shutters closed.

Contact: siic@iitk.ac.in
**A Horizontal Axis Wind Turbine for Augmenting Torque**

Patent Filed

Indian Patent Application No: 212/DEL/2011

Inventor: Dr. Kunal Ghosh

*Department of Aerospace Engineering*

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**A method for increasing energy capture and torque, utilizing core region flow of a horizontal wind turbine**

**Key Features**

- The core region flow around the nacelle is utilized for augmentation of torque and power
- An intake duct positioned in front of the nacelle channels core region flow into the ducts running inside rotor blades. This flow emerges tangentially at the blade tip to create an additional torque
- Further the rotating blades propel air radially outward through ducts and create much suction at the intake and this draws in greater volume of on-coming wind leading additional power

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**Applications**

- The present invention is applicable to all wind turbines with hollow blades
- The invention is useful for companies that are engaged in production of small, medium and large wind turbines for battery charging, remote area small grid operation and contributing megawatts to utility grids

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Contact: siic@iitk.ac.in

IIT Kanpur Technologies | 11
Power Extraction from Photovoltaic Power Sources

Patent Filed


Inventors:
Dr. P. S. Sensarma
Mr. Vasav Gautam

Department of Electrical Engineering

A panel mounted power electronic converter interface for coupling solar photovoltaic panels in series where individual panels have dissimilar characteristics/generation

Key Features

- A unidirectional power electronic interface module for coupling solar panels or equivalent current sources in series
- Each module comprises a cascade boost and buck converter creating a common stiff dc link
- The boost converter ensures appropriate terminal voltage across the solar photovoltaic panel. The buck converter ensures that the voltage of the common dc link is maintained constant under all conditions
- Output stages of each module, and not individual panels, are connected in series
- In-built fault protection, bypass arrangements

Applications

- Solar photovoltaic farms, rooftop solar photovoltaic applications

Contact: siic@iitk.ac.in

IIT Kanpur Technologies | 12
A toilet system, *(Zero Discharge Toilet System)* that does not need any discharge/disposal in the environment

**Key Features**

- The two streams (fecal and urine) is kept separate as it comes out of the human body
- Converting mixture of flush water and fecal matter into recyclable water and usable end products
- The concept of recycling at the toilet level
- A device is provided for segregating fecal slurry from the liquid
- Less water is required in this system (1/10)
- Environment friendly, compact and flexible system

**Applications**

- Eco-friendly sanitation can be implanted by municipal corporations, every household, city/town development authorities, villages etc
Fuel Vaporizer

Patent Filed

Indian Patent Application No: 3196/DEL/2013

Inventors:
Dr. Avinash Kumar Agarwal
Mr. Akhilendra Pratap Singh

Department of Mechanical Engineering

Key Features

- Fuel Vaporizer for preparing homogeneous mixture of fuel and air using waste heat from engine exhaust, which converts liquid fuel droplets into fuel vapor.
- Fuel is sprayed into a pre-chamber whose walls are heated by engine exhaust.
- Fuel droplets of the spray impinge on the chamber wall, and vaporize owing to the elevated chamber wall temperature.
- High velocity air stream is optimally supplied into the chamber, inducing improved air-fuel vapour mixing.
- The improved homogeneity of the mixture thus forms combustible charge suitable for HCCI combustion, thereby improving the efficiency of HCCI combustion.
- Simultaneous reduction of NOx and particulate matter (PM) to ultra-low emission levels.

Applications

- Application of this device is in achieving HCCI combustion in internal combustion engines.
- Automotive majors may be the end user for this because this technology will be helpful in meeting stringent emission norms.
Tangentially Fed Hydrogen Fuel Swirl Burner

Patent Filed

Indian Patent Application No: 2545/DEL/2013

Inventors: Dr. D P Mishra

Department of Aerospace Engineering

Hydrogen Gas Burner and Method of Combustion in Hydrogen Gas Burner

Key Features

- The location of the fuel injection ports vis-à-vis the combustion air allows more residence time and better mixing.

- Swirl is imparted to the injected fuel by means of tangential entry of fuel jets into the combustion air

- Tangential air injection

- Higher combustion efficiency with very low emission levels

- Eliminates the upstream structural arrangement otherwise needed for achieving mixing.

Applications

- Industrial concerns which use combustion as the heat source

- As a part of oxy-hydrogen burner systems of independent inventions and of concern especially to the process industry

- For retrofitting and as a ready replacement for existing systems.
Machines and Manufacturing

Source: http://www.perpetualwatch.com/chronograph.html
Profile Measurement Machine

Patent Filed


Inventors:
Dr. Abhijit Kushari
Mr. Sanjeev Kumar Gupta
Dr. C. Venkatesan
Dr. C. S. Upadhyay

Department of Aerospace Engineering

A device and method for measurement of measuring a surface profile of an airfoil

Key Features

- It is a contact based technique which uses long arm based transducers
- The device is fast accurate and reliable and is capable of measuring an array (1D or 2D) of points on a surface simultaneously

Applications

- Accurate measurement of surface profile is an important requirement in engineering/industry (specially in Aeronautical/Aerospace engineering)
Two Dimensional Nano-Positioner

Patent Filed


Inventors:
Dr. Anjan Kumar Gupta
Mr. Reetesh Kr. Singh
Mr. Rajiv Shankar Sinha

Department of Physics

Two dimensional electromechanical positioning of samples of the order of nano meters

Key Features

- Bimorph is used to achieve planar two-dimensional motion
- The Nano-positioner is specially designed to precisely position samples under high resolution microscopes
- No mechanical access is required to operate this device
- Resolution of positioner is 50 nano meters in both X & Y directions
- Nano-positioner’s span area is 1cm×1cm
- This device is quite compact in size (2.5cm×2.5cm×1cm) and ultra light weight (less than 30 grams)

Applications

- It can be used in vacuum, at cryogenic temperatures in various applications like optical microscope, SPM, SEM, FIB, fiber positioned in optics
- The device can be used in high magnetic fields and temperature range of operation is -270 °C to 45 °C.

3-D exploded view of a two dimensional nano positioned.
**A New Self Configurable Modular Robot**

**Patent Filed**


**Inventors:**
Dr. Bishakh Bhattacharya
Mr. Ankur Agarwal

**Department of Mechanical Engineering**

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**Concept of reconfigurable modular robots, i.e., machines with variable morphology and which comprise of several identical modules**

**Key Features**

- The crux of the project has been the design of the gripping + locking mechanism

- The modules have a dual purpose gripper mechanism installed on them, which can either be used for locking and unlocking with other modules on requirement, as well as for tasks like rope climbing and fetching

- Different modules can increase or decrease their functionality, for example degree of freedom

- The design using SMA (shape memory alloy) wires is completely innovative but extremely simple

- To keep it light weight the chassis has been made by removing material by drilling several holes. Weight of each chassis was reduced by 20%

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**Applications**

- Robotic manipulator used in various industries
- In areas of defense and security, search and surveillance, disaster management, and so on

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*Two Modules Locked together*
Electrospinning Apparatus for Producing Nanofibers and Process thereof

Patent Filed


US Patent Application No.: 12/246,744

Inventors:
Dr. Dhirendra S. Katti
Mr. Amit Nandan
Mr. Riju Mohan Singhal

Department of Biological Sciences and Bioengineering & Chemical Engineering

A method and apparatus for electrospinning to produce aligned and crossed nanofibers

Key Features

- A simple and efficient method of determining the optimal speed for nanofiber alignment

- Stainless steel pin is used as anti-electrode coupled with lateral surface of a rotating wooden disc as substrate

- Unique set up that is a modification of the electrospinning technique for the production of aligned nanofibers

Applications

- Fabrication of filtration systems
- Wound healing and other biomedical applications
**Magnetic Float Levitative Finishing**

Patent Filed


Inventors:
Dr. J. Ramkumar
Mr. Sunil Jha

*Department of Mechanical Engineering*

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**Nano form finishing of high speed ceramic balls by magnetic float levitative finishing process with better control of finishing action**

**Key Features**

- Levitational force is generated by magnetic fluid and permanent magnets it is non uniform in nature and partly controllable

- Two types of magnet schemes are used in this process. First is with one core and one permanent magnet

- For better stability of float and uniformity of forces the magnetic lifting force is generated by multiple electromagnets at the base and permanent magnets on the float

- Better control over levitational forces

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**Applications**

Form finishing of
- Ceramic Ball of varying diameter
- Stainless steel Ball of varying diameter

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*Schematic of the magnetic float levitative finishing apparatus*
A Device for Magnetic Abrasive Finishing of a Workpiece and Magnetic Abrasive Finishing Process

Patent Filed
Indian Patent Application No: 2309/DEL/2008

Inventors:
Mr. Sunil Jha
Dr. J. Ramkumar
Mr. Sandeep Nair

Department of Mechanical Engineering

A device for magnetic abrasive finishing of multiple workpieces and magnetic abrasive finishing process (MAF)

Key Features

- It is based on the electro-magnetic behavior of magnetic abrasive particles
- In MAF, the magnetic abrasive particles align themselves along the magnetic lines of force forming a flexible magnetic abrasive brush (FMAB)
- The active magnetic particles trapped between the FMAB and workpiece surface create micro indentation on the workpiece surface and remove material
- MAF is based on the magnetization property of ferromagnetic iron and the machining property of the abrasive used
- Multiple shafts can be finished simultaneously to the same level using this process

Applications

- Finishing of bearings, precision automotive components, ultra high speed shafts used for cryogenic applications and artificial hip joints made of oxide ceramic and cobalt alloy components

Contact: siic@iitk.ac.in
Rotary Abrasive Flow Finishing Process for Finishing and Texturing of Internal and External Surfaces of Hard and Composite Materials and an Apparatus therefore

Patent Filed


Inventors:
Dr. J. Ramkumar
Dr. V. K. Jain
Mr. M. Ravisankar

Department of Mechanical Engineering

Nano finishing process for complex surfaces made of advanced materials.

Key Features

- Design and development of Universal Rotational Abrasive Flow Finishing Process
- Development of rotational tooling to improve the finishing rate
- Comparative study of Abrasive Flow Finishing (AFF) and UR-AFF
- Workpiece rotational speed imparts the Rotational
- The cylinder tubes made of hard steel also finished using UR-AFF process and this process greatly improves the form geometry along with surface finish

Applications

- Medical applications: Nano finishing of biological implants (knee joint, hip joint, heart valves, etc)
- Automobile applications: Finishing of fuel injector nozzles, Engine cylinders
- Die industry: Can finish any complicated shapes of extrusion dies
A Method of Preparing Fiber Reinforced Plastic Articles Using Rubber Pressure Moulding Technique

The invention is based on the matching die set, where the die is made from hard material and the punch from flexible rubber material

Key Features

- Better interlaminar fracture toughness
- Better interlaminar shear strength
- Better tensile strength
- Better modulus
- Less void in the composites
- Less processing processure
- Complex structure can be made

Applications

- This new generation material has immense applications ranging from aerospace, automobiles, medical applications, heavy machinery, space materials, chemical, civil engineering industries, etc

Photographs of complex shaped composite structures made by rubber pressure moulding technique

Contact: siic@iitk.ac.in
Functional Pump Generator

Patent Filed


Design Patent No: 238757

Inventors:
Dr. K. Muralidhar
Mr. Manoj Sharma
Mr. Ankit Jain
Mr. Ras Dwivedi
Mr. Prateek Khanna
Mr. A. Rama Rao

Department of Mechanical Engineering

Medical pump that generates variable fluid flow based on required flow rate profile

Key Features

- This medical pump generates variable flow of liquids of different viscosity and can generate flow of liquid as desired.
- This is advantageous to terminally ill patients that require different dose of fluids at different time interval
- Since the fluid remains non-contacted with external mechanism and thus the possibility of contamination is removed which is the first requirement in medical and healthcare field

Applications

- The invention aims at developing a medical pump and used to deliver fluids in the body in required amount and required time intervals
- Companies manufacturing Medical devices / equipments

Contact: siic@iitk.ac.in
**Novel Liquid-Solid Radically Cross-Flow Multi-Stage Fluidized Bed Contactor**

**Patent Filed**

**Indian Patent Application No:**
830/DEL/2007

**Inventors:**
Dr. Nishith Verma
Mr. Rupesh Verma

**Department of Chemical Engineering**

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**A new type of liquid-solid (L-S) multi-stage contactor is designed and developed**

**Key Features**

- The unique aspect of the invention is the configuration of different types of downspout between two successive stages in the column, one around the outer periphery of the stage and the other at the center of the stage, resulting in much more uniform mixing between the two phases flowing counter currently in the present design than in the conventional stage-wise contactor is claimed and relatively larger mass transfer rate resulting in fewer number of stages.

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**Applications**

- Recovery of protein from biofluids using solid adsorbents
- De-nitrification of liquid enriched with nitrogenous ions using solid resin particles
- Adsorption of fluoride ions from waste water by solid zeolite particles
- The recovery of precious metals from the slurry

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**Figure 1:** Schematic of three stage radial-flow fluidized bed

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Contact: siic@iitk.ac.in

IIT Kanpur Technologies | 11
Modular Unit Attachment for Performing Dry and near Dry Electric Discharge Machining (EDM)

Patent Filed

Indian Patent Application No: 2082/DEL/2008

Inventors:
Dr. Sounak Kumar Choudhury
Mr. Sourabh Kumar Saha

Department of Mechanical Engineering

This invention the dry and near dry operation electric discharge machining

Key Features

- A new machine unit which is used to enable performing the dry EDM process on existing EDM machines (which were originally designed for liquid dielectric only)

- High pressure gas flow is achieved by maintaining a gas flow path from the pressure line to tool through the rotating shaft

- The tool holding part is designed so that tools of different sizes can fit without much leakage of gas at the junction between the tool and the spindle-shaft

- The motor side –mounted on spindle for continuous feed motion of tool

Applications

- The invention can be used as an accessory on an existing EDM (electric Discharge machine) to implement the dry EDM process
A Method for Magnetic Abrasive Finishing using a Pulsating Flexible Magnetic Abrasive Brush and a Magnetic Abrasive Finishing Device

Patent Granted


Grant No.: 255664

Inventors: Dr. V. K. Jain Dr. Raghu Ram Mr. D. K. Singh

Department of Mechanical Engineering

Design and fabricate a Lab setup to enhance the performance of pulsating Magnetic Abrasive Finishing (P-FMAB) compared to the performance of Static FMAB (S-FMAB) so that the finishing rate is improved substantially.

Key Features

- The very important advantage of the invention is the stirring effect/remixing of abrasive within FMAB which enhances abrasive cutting edges due to formation and partial breaking of the cutting brush

- The rate of finishing is increased and the quality of the finished surface is improved substantially

- It gives the final Ra value in the range of few tens on nanometer

Applications

- The applications of super finishing are in the finishing of bearings, precision automotive components, shafts, artificial hip joints, and similar other components

- It is very much useful for deburring and micro deburring of batch production

Potential Applications: Cylindrical & Flat Surfaces

- Precision automotive components
- Gears, Pumps, Valve Trains

MAF Effective in nano finishing, cleaning, deburring and burnishing of metals and advanced engineering material parts and components.

A comparison of ground surface and surface finished by DC MAF without feed and with feed
An Abrasive Flow Finishing Device, an Abrasive Flow Finishing Process and Magnetorheological Polishing Fluid

Patent Granted


Grant No.: 255847

Inventors:
Dr. V. K. Jain
Mr. Sunil Jha

Department of Mechanical Engineering

The newly developed process was named as "Magnetorheological Abrasive Flow Finishing (MRAFF)" which maintains the versatility of AFM process and at the same time introduces determinism and in-process controllability of rheological properties of abrasive laden medium of MRF, to give nano level surface finish on 3-D complex surfaces

Key Features

- In-house, synthesis of the magnetorheological polishing fluid
- Initial surface roughness 280 nm has been brought down to 100 nm

Applications

- Complex shaped 3-D components, cylindrical internal and external surfaces, miniature holes and micro channels, etc
Process for Drilling Contoured Deep Hole in Super Alloys using STED to Enhance Cooling in Turbine Blades

Patent Filed


Inventors:
Dr. V.K. Jain
Dr. R. Shekhar
Dr. D. S. Bilgi
Mrs. Anjali V. Kulkarni
Mr. Aatish Chavan

Departments of Mechanical Engineering & Materials Science and Engineering

An acidified electrolyte with acid concentration of 2 wt % has been used successfully for drilling contoured holes in Nimonic super alloys at 1.00 mm per min. Machining

Key Features

- Contoured hole profile has a close resemblance with the theoretical designed profile. There is some deviation observed in the experimental profile and the analysis revealed the range of average radial deviation is from 0.125 mm to 0.305 mm.

- Contoured holes improve the cooling efficiency of the turbine blades.

- The use of an acidified electrolyte increases safety.

Applications

- Turbine Blades
- Where better mixing of the fluids is required
- Where more efficient heat transfer is required

Schematic diagram of tool feed arrangement of STED machine
An improved Oven

Patent Granted

Indian Patent Application No: 1292/DEL/2004

Grant No: 251576

Inventor: Dr. D. P. Mishra

Department of Aerospace Engineering

This tandoor oven is an improved version of traditional one which can provide shorter initial heating time, lower emission and cheaper as it uses a LPG gas burner

Key Features

- A new annular LPG burner is designed and developed to provide hot gases through the annular region of tandoor oven made out of baked mud

- The width of annular passage of tandoor oven is optimized to have better performance

- Number of hole s and its size on the inner casing are optimized to have better ventilation of hot gas and baking of roti

Applications

- The burner can be used by all commercial cooking establishments like hotels, hostels, restaurants

- The burner can be used combustor for drying, and steam generation, large scale boiling etc

Schematic of Tandoor oven.
A Finishing Device

Patent Filed

Indian Patent Application No: 1541/DEL/2010

Inventors:
Dr. V. K. Jain
Department of Mechanical Engineering

Mr. Prabhat Ranjan
Dr. V. K. Suri
Dr. R. Balasubramaaniam (BARC, Trombay)

A method and apparatus for finishing flat silicon surface employing Magnetorheological fluids and the fluid compositions used therein

Key Features

- The developed process is called as “Chemo-mechanical magnetorheological finishing (CMMRF)” which combines the advantages of chemo mechanical polishing (CMP) and magnetorheological finishing (MRF). The best surface roughness value achieved was 0.48 nm

- The finishing set-up was similar to MRF process. Hence, flexible polishing pad removes shape limitation on workpiece surface to be finished

- The process will be useful to develop highly precise finish on hard workpieces

Applications

- Nanofinishing of silicon mirrors which is used in synchrotron beam line

- Finishing of single crystal silicon for fabrication of integrated circuit (IC) in electronic industries

- Finishing of flat surfaces of different material (metallic and non-metallic) to nano meter level

SEM image of (a) unfinished and (b) finished silicon workpiece surface, and (c) photograph of finished silicon workpiece with reflection of “IITK-BARC-DST” on it.
A Novel Tube-Well Hand Pump

A versatile tube-well hand pump with energy harvested water filtration.

Key Features

- A versatile tube-well hand pump that filters and purifies the water without using any electricity.
- It has two options to enable/disable filtration by using a by-pass mode.
- It also provided limited illumination around the tube-well area in the night time.
- The inbuilt energy harvester can generate energy required for water filtration & purification.
- It has networked water quality monitoring system.

Applications

- A versatile hand pump for semi-urban and rural population of India to provide safe potable water for healthy life.

Indian Patent Application No: 2727/DEL/2012

Design Patent No: 24992

Inventors:
Ms. Shanu Sharma
Dr. J Ramkumar
Dr. Bishakh Bhattacharya
Mr. Aravind Shanmuga Sundaram M

Department of Mechanical Engineering & Design

Contact: siic@iitk.ac.in
**Finishing Apparatus**

*Patent Filed*

**Indian Patent Application No:**
4074/DEL/2012

**Inventors:**
Dr. V K Jain
Mr. Pawan Basera
Dr. V K Suri
Dr. R Balasubramaniam

*Department of Mechanical Engineering & BARC, Trombay*

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*An apparatus for nanofinishing of races of aircraft’s blade bearings.*

**Key Features**

- A magnetic abrasive finishing (MAF) apparatus is developed for nanofinishing of races of aircraft’s blade bearing.
- A low cost and more efficient finishing processes used for finishing of blade bearings that reduces friction.
- Use of a flexible MAF brush which is self deformable
- Use of diamond particles in MAF medium to reduce total finishing time.
- Strength of MAF brush can easily be varied by changing working gap or electric current to the electromagnet without changing any process parameters.

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**Applications**

- Finishing of races of aircraft’s blade bearing. However, it can be also used for other components having similar shape as of blade bearing
- Components which are finished by this process do not require any post finishing operations
- The developed technology does not destroy the form geometry of the component to be finished.

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*Drilling Machine*

*Tooling System*

*A setup for finishing bearing components*
Affordable In-house Modular Planetarium

Patent Filed

Indian Patent Application No: 730/DEL/2013

Inventors:
Ms. Nidhi Pashine
Mr. Akshat Singhal
Mr. Shubham Gupta

Department of Physics & Civil Engineering

A Small affordable and modular planetarium build using plywood, PVC pipes and cloth which uses a spherical mirror projection system.

Key Features

- A low cost modular structure, made up of PVC pipes (struts) and pyramidal plywood hubs which act like connectors.
- Did not involve any industrial process.
- Uses a single spherical mirror LCD projection system (to cover the entire dome) and a cotton cloth for the screen.

Applications

- As an educational tool to simulate the night sky in a backyard planetarium.
- As a simulator for training purposes for simulating different geographical terrains.
- For entertainment: to create a 3D immersive and interactive environment/gameing (using motion sensing devices).

Contact: siic@iitk.ac.in
Two way Volume Adjustable Load Bearing Foldable Unit in Pliable Material for Making Furniture

Patent Filed

Indian Patent Application No: 1481/DEL/2013

Inventors:
Ms. Meenakshi Singh
Dr. Koumudi Patil

Department of Design Programme

Two Way Volume Adjustable Load Bearing Foldable unit pliable material for making furniture

Key Features

- Load bearing light weight structure along with the property of volume adjustability in two dimension, collapsible, local expansion and contraction, porosity and deployable in nature.

- Substantially made of paper along with use of adhesive for interlinking.

- The innovation amplifies the strength of pliable material through folds.

- Shape of the furniture can be reconfigured without permanent deformation

Applications

- Light-weight space-saving ergonomic furniture for people on move, home and offices.

- Can be used for heat dissipation with minimal surface contact.
Two-Fluid Atomizer

Patent Filed

Indian Patent Application No: 1551/DEL/2013

Inventors:
Dr. D P Mishra
Ms. Manisha B Padwal

Department of Aerospace Engineering

Internally Impinging Two-Fluid Atomizer for Non-Newtonian Shear-Thinning Fluids

Key Features

- Modification of the design of conventional internally mixed atomizer.
- Ability to enhance the atomization quality of highly viscous non-Newtonian fluids by utilizing only a small amount of atomizing air at low pressure.
- Reduced clogging problems.
- Short mixing zone, smaller residence time for the two-phase flow, and a simple and compact geometry.

Applications

- Industrial Application in the areas of agricultural chemicals, spray dryers, paints, tablet coating, and food items
- Manufacturers of heating furnaces
- Gas turbine industry
- Rocket and missile engine industry

Comparative images showing atomization of Jet A1 gelled fuel in (I) conventional internally mixed and (II) proposed invention of the internally impinging atomizer (ALR ~8%).
**Interactive Board Game**

**Design Patent No:** 24991

**Inventors:**
Ms. L V Sairam Jagatani
Dr. Nirmalya Guha
Dr. J Ramkumar

**Department of Design Program**

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**Interactive Board Game based on Indian Logics**

**Key Features**

- A board game with Inferential strategy planning and inferences
- It contains board in number of pieces of hexagonal form blocks
- It includes 3 steps of play processes forming the battle field, arranging the pawns and game play
- Flexibility in shape and size of the board and inspiration for the game comes from Indian logics in creating inferences which is unique in contemporary games

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**Applications**

- Large scope for making this game into an web-based game
Millimetre Level Measuring Ruler for Measuring by Touch

Patent Filed

Indian Patent Application No: 650/DEL/2013

Inventors:
Mr. A Madhavan
Ms. Shanu Sharma
Mr. Aravind Shanmuga
Dr. J Ramkumar

Department of Mechanical & Design Engineering

Key Features

- The millimetre distance is magnified to a finger friendly target making it tactile sensitive & Braille assisted with a resolution of 1 mm
- The ruler comprises of ruler based, multimeter pointer and delimeter

This invention will assist partially/fully visually impaired people to measure the distance by this ruler up to a minimum count of 1 millimetre.

Applications

- Aid for partially/fully visually impaired people for doing accurate measurements.
Materials

source: http://craftzine.com/handmade/edmunds
Tubular Microwave Sintering Furnace

Patent Filed


Inventors:
Dr. Anish Upadhyaya
*Department of Materials Science and Engineering*

Mr. G. Swaminathan *(Sr. DGM, BHEL, Hybd)*

A tubular microwave sintering furnace having arrangements for temperature and gas atmosphere control which offers low cost sintering and a simple flexible arrangement to precisely control the process parameters

**Key Features**

- Tubular arrangement of the sintering furnace is economical and provides time efficient metallic sintering
- It enables effective heating of the sample in lower region of furnace
- It has provision for both infra-red as well as thermocouple based temperature measurement and control system for initial calibration

**Applications**

- Sintering of metallic samples

*Micro wave Furnace system schematics*
**Rare-Earth Oxide Dispersed Sintered Stainless Steels (REO-Steels)**

Patent Granted


Grant No.: 255842

Inventors:
Dr. Anish Upadhyaya
Dr. R. Balasubramaniam
Mr. J. Shankar

*Department of Materials Science and Engineering*

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**Key Features**

- REO-dispersed steels exhibit an increase up to 90% hardness up to 15% as compared to conventional steels

- A novel powder stainless steel (up to 10 wt% yttria Y₂O₃) is formulated using controlled using controlled quantities of rare earth oxides in ferrite stainless steel powder with modification in solid state and supersolidus sintering

- High hardness, wear resistance as well as superior corrosion resistance

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**A powder metallurgical process of producing a improved class of stainless steels with addition of controlled quantities of rare earth oxides additives**

Applications

- Automotive, chemical, and structural applications

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*SEM micrographs of (a)stainless steel and (b)Yttria powder*
**Advanced Sintering System**

Patent Filed

Indian Patent Application No: 1792/DEL/2010

Inventors:
Dr. Bikramjit Basu
Mr. K. Madhav Reddy
Ms. K. Pavani

**Department of Materials Science and Engineering**

**Multi-stage spark plasma sintering to develop dense materials with better and uniform mechanical and tribological properties in both conducting and non-conducting ceramic**

**Key Features**

- It addresses ‘controlled spark discharge’ by holding powder compact at intermediate stages prior to sintering temperatures via Multi stage sintering (MSS) for different non-conducting ceramic materials
- The method includes maintaining a powder compact up to one/more intermediate holding temperature for different timescale before holding at the final sintering temperature in a spark plasma sintering chamber, as opposed to directly heating to a sintering temperature in a conventional sintering process
- Homogenous densification with fine grain microstructure, leading to uniform as well as better mechanical and tribiological properties, than the single stage sintered ceramics

**Applications**

- Electrical Insulators
- Seal faces and valve sates
- Orthopaedic implants
- Refractory and armor applications

(a) single stage sintering (SSS)

(b) Multi-Stage Sintering (MSS).
A Blue Organic Light Emitting Diode and Method of Fabrication thereof

Patent Filed

Indian Patent Application No: 2214/DEL/2008

Inventors:
Dr. Deepak Gupta
Mr. K. N. Narayanan Unni
Ms. Girija S. Samal

Department of Materials Science and Engineering

Improved efficiency of a blue OLED by introducing multiple hole transport layer and emitting layer interfaces

Key Features

- Reduce the total current and to improve the light output so that the current efficiency is improved
- Blue Organic Light Emitting Diode with improved efficiency by stepwise insertion of HTL into EML thereby achieving multiple HTL/EML interfaces in the EML
- Improved the overall performance of a full color OLED display

Applications

- Full colour displays
- Lighting sources
Simplified concepts of a butt joint using reinforced adhesives of two components of either similar or dissimilar materials

Key Features

- A sheet of balanced glass fiber reinforced with adhesive resin is wound along the joining interface of the pipes
- A plurality of layers of adhesive reinforced balanced glass fiber is wound at the joining interface
- The winding of the multiple layers of the fabric may have different configurations
- Curing is done at room temperature, helps to preserve the parental properties of the material and binds multiple layers of the reinforced fabric together
- In the cold joining of components made of dissimilar materials occurs without changing the properties of the components
- Joining of different cross section, thickness and co-efficient of thermal expansion

Applications

- Piping industries like chemical, Petroleum, underground piping, underwater structures etc
**Fabrication of Jute Fibre Sandwich Composites**

Patent Filed

Indian Patent Application No: 1688/DEL./2008

Inventors:
Dr. Prashant Kumar
Dr. J. Ramkumar

**Department of Mechanical Engineering**

**Development of jute fibre reinforced sandwich composites which can be used as sheeting covers**

**Key Features**

- Reinforcing fibers are cost effective and widely available natural fibers
- The layer of natural fibers forms the outer covering on both sides, a foam, which is not chemically attacked by the resin employed, forms the middle layer or the core structure of the panel
- The resin forms columns passing through the foam layer and joining the two outer natural fiber layers to forms a composite structure

**Applications**

- Micro, Small and Medium Enterprises (MSME) segment of the Indian economy is very vast, very large number employed, can take the concept and develop many products like doors, table top and thin panel as per customer requirement

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**Schematic diagram of sandwich-panel with resin columns.**
A nickel coated carbon fiber reinforced polymer composites and a method for the preparation thereof which results in a high performance composite with improved thermal and mechanical properties for structural application through the use of nickel coated carbon fibers/fabrics

Applications

- Applications ranging from aerospace, automobiles, medical applications, heavy machinery, space materials, chemical, civil engineering industries, etc

Key Features

- The nano material is grown on the surface of carbon fiber, i.e. it is an insitu process
- Need not add nanomaterials during the fabrication of nanocomposites in the polymer matrix which is much more difficult to disperse in the matrix
- Excellent thermal stability is obtained.
- Uniform coating of nanomaterials can be obtained
- The processing is cost effective
Functionally Graded Magnetic Materials and a Method for Preparation of the same

Patent Filed


Inventors:
Dr. Kamal K Kar
Mr. Ahankari Sandeep Sureshrao

Material Science Programme

Development of a novel functionally graded magnetic material using polymer matrix, nano/micron sized magnetic materials and other chemicals. The gradation of nano/micron particles comprises a varying particles size and weight% in rectangular and cylindrical and other complex geometries

Key Features

- Magnetically anisotropic functionally graded sheets are used for firm holding
- A multilayered functionally graded magnetic structure is possible without any adhesive layer between them
- The base material used is polymer so that it can be easily clipped and conform to different structures
- A wide range of gradation is possible, 0 to 1200 % by weight

Applications

- Automotive: (Starter motors, Anti-lock braking systems (ABS), etc)
- Electronic and Instrumentation: (Sensors, Contactless switches, NMR spectrometer, etc)
- Industrial: (DC motors for magnetic tools, Robotics, etc)
- Astro and Aerospace: (Frictionless bearings, Stepping motors, etc)
- Biosurgical: (Dentures, etc)

Variation of saturation magnetization in functionally graded magnet as a function of applied field.
A novel functionally graded polymer(s)/polymeric nanocomposite(s) [FGP(s)/FGPNC(s)] having a variation of glass transition temperature including other

**Key Features**

- Large scale gradation of FGMs is possible
- Can be used for wide range of temperatures
- The gradation of nanocomposites comprises a varying particles size and volume fraction of nanoparticles(s) and processing oil(s) in rectangular and cylindrical and other complex geometries
- High strength to weight ratio properties, exceptional temperature and corrosion resistance, high fatigue strength, excellent impact resistance and many enhanced properties are achieved.

**Applications**

- Applications, viz., automobile, aircraft, space craft, sports, etc.
- Various types of composite materials can be obtained, i.e., polymer matrix including thermoplastic and thermosetting, ceramic matrix, etc.
Functionally Graded Polymer Nanocomposites/Composites having Crosslinking Density Variation and their Manufacture

**Patent Filed**


**Inventors:**
Dr. Kamal K. Kar
Mr. Ahankari Sandeep Suresh Rao

**Material Science Programme**

A Process is developed where polymeric FGMs are produced from polymer which are available in solid state

**Key Features**

- The gradation of nanocomposites comprises a varying particles size and volume fraction of nanoparticles(s) in rectangular and cylindrical and other geometries
- This graded materials having a variation of chemical crosslinking density that graded the performance of materials in the target applications
- It has been developed by using polymer matrix(s), nano sized filler(s), curing agent(s), accelerator(s) and other chemicals

**Applications**

- Applications are in automobiles, aircraft, spacecraft, tires, etc
- Bio-medical applications like flexible tubing for pacemaker leads, vascular grafts etc

Variation of crosslink density with distance
An Improved Organic Light Emitting Diode and Improved Light Emitting Diode for Tuning the White Emission and Process for Fabrication thereof

Patent Filed

Indian Patent Application No: 1532/DEL/2005

Inventors:
Dr. Monica Katiyar
Ms. Asha Sharma
Dr. Deepak Gupta
Dr. ShuSeiki

Department of Materials Science and Engineering

Organic room temperature UV emitting device which also emit white light

Key Features

- Fabrication of organic LEDs is done by Si chain backbone polymers with organic side groups
- UV emission from polysilanes is converted to visible emission and white light for flat panel display and home lighting respectively
- Organic LEDs offer various advantages over inorganic LEDs: easy processability, large area devices, flexible if made on plastic surface, high efficiency, large viewing angle and high brightness
- The challenge is to get room temperature UV, NUV emission from LEDs made of these material

Applications

- Industries involved in making “Information Displays” & “Lighting”

Absorption and PL emission spectra of poly(n-butylphenylsilane (PS-4) in toluene solution)
A Process for Preparation of Micron Sized High Molecular Weight Polymer

Patent Filed


Inventors:
Dr. Kamal K. Kar
Mr. Pradip Paik

Material Science Programme

The invention the preparation of high molecular weight micron sized polymers (Mw~1x105)

Key Features

- Spherical particle
- Better crystallinity
- Better modulus
- 98% yield

Applications

The uses of polymer microparticles include

- The creation of nanostructured materials using lithographic technique
- Fabrication of nanoscale devices for sensing the electrical and fluorescence properties
- Production of nanoscale arrays for electronic, and optoelectronic devices
- Membrane filters with controlled pore sizes
- Well defined layers in blends
- Polymer particles having metallic coating used for passive damping and energy-absorption systems
- Flip chip packing application, etc.

Contact: siic@iitk.ac.in
**Novel Low Temperature Synthesis of Nd-Doped Bismuth Titanate Nanoparticles**

Patent Filed


Inventors:
Dr. Ashish Garg  
Dr. H. C. Verma  
Mr. Mukesh Roy  
Mr. Prem Prakash

*Department of Materials Science and Engineering & Physics*

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**A low temperature synthesis of nanoparticles of ferroelectric Nd-doped bismuth titanate using a simple chemical route**

**Key Features**

- Lowering of synthesis temperature
- Ferroelectric nature of the nanoparticles
- Simplicity of ingredients and the synthesis process yielding good quality ferroelectric nanosized BNdT material
- Simple, cheap and potentially scalable method

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**Applications**

- In the areas of microelectronics, as in fabrication of electronics devices, sensors, detectors and actuators etc

*Selected Area diffraction pattern of the powders calcined at 600 ºC*
A magnetic polymer composite and the process for the preparation of the same for the read and write head for use in magnetic storage devices

Key Features

- A magnetic polymer composite comprising 60-90% by weight of polymer, 10-40% by weight of magneto resistive alloys and 5-30% by weight of additive

- Prepared by a process by dissolving 60-90% by weight of the polymer in a solvent to obtain a clear colorless solution

- Adding the alloy and additive to this solution and agitating the mixture at a frequency of 15-20 kHz to get a dispersed magneto resistive alloy in the said polymer solution

Applications

- Used as polymer magneto resistive alloy composite coating in avionic tube applications

- Recording media industry, tape material manufactures

Method of Preparing Magnetic Polymer Material Composites with Magnetic and Electrically Conducting Features

Patent Granted


Grant No: 216744


Inventors:
Dr. S. Sundar Manoharan
Ms. Manju Lata Rao

Department of Chemistry
Magnetic CrO₂ Polymer Composite Blends

Patent Filed

Indian Patent Application No: 933/DEL/2000,

Grant No: 217159


Inventors:
Dr. S. Sundar Manoharan,
Dr. Yashowant N. Mohapatra
Mr. Samarendra Singh
Mr. Qureshi Mohammad

Department of Chemistry & Physics

**Magnetic CrO₂ polymer composition blend for use in magnetic storage devices, such as in the audio and video tapes as magnetic read heads, magnetic field probes, or current voltage sensors in electrical devices and the process for the preparation of the same to provide a matrix for magnetic fillers.**

**Key Features**

- A magneto resistive CrO₂ alloy composite blend comprising 90-95% by weight of the polymer preferably low density polyethylene, 5-10% by weight of magnetic filler preferably CrO₂ and 2-4% by weight of an additive.

- Prepared by the process of mixing the said polymer and heating at a temperature of 95-1000°C to obtain a blender melt.

- The blend is casted between two metal plates to obtain sheets of magnetic polymer by applying uniaxial pressure.

**Applications**

- For magneto resistive applications, to provide suitable magnetic core in CRT tube application in the place of γ Fe₂O₃

- Magnetic Recording Industry.
A line based image matching method for retrieving a model image indexed by similar shape descriptors to a query image from an image database indexed by line based shape descriptors.

**Key Features**

- Technologically important gamma Fe$_2$O$_3$ is prepared by a furnace less, one step process, employing microwaves in unison with the principle of self catalyzed combustion reaction.

- The novel method emphasizes the selective isolation of the gamma phase against the alpha phase by a judicious choice of the reactant mixture and control of processing conditions.

- Successful doping of Co ions in gamma Iron oxide is also achieved up to 10% with indication of no impurity phase.

- The method uses microwave radiation and inorganic precursors accompanied by the rapidness of the product formation which modifies the surface and magnetization properties.

**Applications**

- Useful for magnetic recording and storage industry.

- Biomedical applications such as malignant hyperthermia treatments.

*Histogram showing the particle size of γ-Fe2O4*
White Light Emitting Zinc Based OLED

Patent Filed


Inventors:
Dr. S. Sundar Manoharan,
Dr. Yashowant N. Mohapatra
Mr. Samarendra Singh
Mr. Qureshi Mohammad

Department of Chemistry & Physics
Applicants Name: Samtel Color limited

Method for the manufacture of a white light emitting diode

Key Features

- White organic light-emitting diodes (OLEDs) having spectral width of approximately 260 nm in electroluminescence (EL) in a simple bilayer structure, consisting of TPD and zinc benzothiazole, without taking recourse to complex strategies such as blending and doping.

- The EL is broader than the corresponding photoluminescence (PL) of both component materials and their structures.

- A deconvolution of PL and EL spectra shows that as large as 60% of the broad EL emission originates from multiple exciplexes formed at the interface during electrical excitation.

Applications

- For organic light emitting device
- LED lighting device companies, like Philips, Osram etc
Corrosion Resistant Phosphoric Iron for Concrete Embedment and Reinforcement Applications

Patent Filed

Indian Patent Application No: 1823/ DEL/2005

Inventors:
Dr. R. Balasubramaniam
Mr. Gadadhar Sahoo

Department of Materials Science and Engineering

Reinforcement steel/ Embedment, which is corrosion resistant in concrete, buildings, bridges and similar civil works

Key Features

- Corrosion which degrades the reinforcement steel/ embedment in concrete has lots of concerns for obvious reasons. The present problem of corrosion is being overcome by using costly materials like copper, chromium molybdenum, vanadium, etc

- The present inventions proposes a cost effective composition including phosphoric iron that is cheaper

Applications

- Iron and Construction industry Companies manufacturing Medical devices / equipments

- Manufacturing Iron and steel, (Tor)
A Method for Creation of 2 and 3-Dimensional Micro Channels of Varied Dimensions using Replication and Molding around a Wire

Patent Filed

Indian Patent Application No: 1455/DEL/2008

Inventors:
Dr. Bikramjit Basu
Dr. Shantanu Bhattacharya
Mr. Rajeev Kumar Singh

Department of Materials Science and Engineering & Mechanical Engineering

A process to produce 3-D micro-channel in PDMS by soft lithography using a copper wire of 40-80 μm diameters. This technique can be used to carve 3-D shapes within PDMS polymer, which can have impact of micro-fluidic transport and sensory development

Key Features

- Replication and molding around a copper wire is used to make 2-D and 3-D micro-channels
- The dimensions of the channel vary from 40-80 microns
- Different shapes of copper wires can be used to create intricate features
- Anhydrous toluene is used removal of copper wires
- These techniques can be used to formulate novel solenoid valving mechanism and micro-fluidic damper
- The fabrication method can also be used for nanometer range channels and cavities in soft polymeric materials like PDMS

Applications

- Biomedical engineering
- MEMS researcher
- Chemical and medical sensors
- Micro-fluidic transport
Functionally Graded Wide-Band Polymeric Composites for Microwave Absorbers and Method of Manufacturing the same

Patent Granted


Grant No.: 255975

Inventors:
Dr. Kamal K. Kar
Dr. Animesh Biswas
Mr. Ahankari Sandeep Sureshraj

Materials Science Programme & Department of Electrical Engineering

Development of functionally graded polymer composite materials (FDPMs), having a wide range of band gap in microwave-absorbing range

Key Features

- Functionally graded polymer structure is made with or without any adhesive layer between stacks of composite structure
- Gradation in polymer matrix has led to broadband absorption and gives high permittivity on the front side and high permeability on the rare side
- Flexible polymer base material is used
- Lesser processing cost

Applications

- In Military applications like stealth technology
- Usage in automotive industry as in control devices
- Noise resistance of electronic equipments like TV, radio, microwave oven, etc
- To minimize electromagnetic interference in electronic and electrical devices by micro-wave absorption technology

Comparison of UDPC (uniformly dispersed polymeric composite) and FGPC (functionally graded polymeric nanocomposites) for an equal average volume fraction and thickness
A Hybrid Ink formulation and a Method for preparing the same

Patent Filed

Indian Patent Application No: 1161/DEL/2012

Inventors:
Mr. Saumen Mandal
Mr. Rahul Sharma
Dr. Monica Katiyar

Department of Materials Science and Engineering

Oxide nanoparticle incorporated organic dielectric ink, is used to enhance the dielectric constant of organic dielectric

Key Features

- The hybrid ink containing inorganic nano-particles having high dielectric constant that enhances the dielectric constant of the organic host material. We also claim the process to incorporate >50 wt% inorganic nano-particles in organic ink
- Formulation of a water based hybrid dielectric ink
- PVA solution in water is not readily printable because of its high viscosity and surface tension. We have formulated PVA ink and have printed capacitors using inkjet printing on PET substrate using the same
- Concept of TiO₂ nano-particle incorporation in PVA to enhance the dielectric constant of organic dielectric
- We have invented a process to incorporate >50 wt% TiO₂ nano-particles in PVA ink. The same has also been used for Inkjet printing of TiO₂ nanoparticle incorporated PVA layer

Applications

- Organic transistor or capacitor with minimum threshold or operating voltage can be printed easily using our technology
- It will be a crucial input in development of large number of organic devices that can be fabricated using printing, like organic thin film transistor or organic capacitor on flexible substrate like plastic or metal sheet, and also as passivation layer of OLED and solar cell
- This film will act as a UV protecting layer also

Contact: siic@iitk.ac.in
A magneto-resistive polymer composition for use in magnetic storage devices and the process for the preparation of the same to provide a matrix for conducting and magnetic fillers to form a blend which in turn shows the desired magneto-resistive property.

Key Features

- A magnetic polymer composite comprising 60-90% by weight of polymer, 10-40% by weight of magneto resistive alloys and 5-30% by weight of additive is reported.

- Prepared by the process by dissolving 60-90% by weight of the polymer in a solvent to obtain a clear colourless solution.

- Adding the alloy and additive to this solution and agitating the mixture at a frequency of 15-20kHz to get a dispersed magneto resistive alloy in the said polymer solution.

Applications

- Used as polymer magneto resistive alloy composite coating in avionic tube applications.

- Recording media industry, Tape material manufacturers.
A magnetic conductive polymer composition for read and write head and process for preparation for use in magnetic storage devices

**Key Features**

- A magnetic polymer composite comprising 60-90% by weight of polymer, 10-40% by weight of magneto resistive alloys and 5-30% by weight of additive
- Prepared by the process by dissolving 60-90% by weight of the polymer in a solvent to obtain a clear colorless solution
- Adding the alloy and additive to this solution and agitating the mixture at a frequency of 15-20kHz for a period of 5-30 minutes to get a dispersed magneto resistive alloy in the said polymer solution

**Applications**

- For used as polymer magneto resistive alloy composite coating in avionic tube applications

Contact: siic@iitk.ac.in
A Photolithographic Process for the Preparation of OLED Displays

Patent Filed

Indian Patent Application No: 2538/DEL/2012

Inventors:
Mr. Ankur Solanki
Dr. K N Narayanan Unni
Dr. Asha Awasthi
Dr. Deepak Gupta

Department of SCDT

A new lithographic technique which helps in reducing the number of etching defects on substrates for OLED displays

Key Features

- The fabrication process of organic light emitting diode (OLED) displays is cost effective
- It removes defects such as dead pixel, dark columns and bright horizontal rows
- It fabricates defect free panels
- Higher production yield is obtained
- Drastically reduces the number of anode shorts in a substrate for OLED display

Applications

- Can be used mainly but not limited to increasing production yield of OLED display production.
- Can be used for certain multilayer patterning also

(a) Display fabricated by traditional process
(b) By new process
A Medium for Nanofinishing of Complex Component’s Internal/External Surface and a Method for Preparation thereof

Patent Filed

Indian Patent Application No: 712/DEL/2013

Inventors:
Dr. Ravi Sankar
Dr. V K Jain
Dr. J Ramkumar

Department of Mechanical Engineering

Method of preparing polymeric composition comprising of multiple polymers, rheological additives and abrasive particles to nano-finish simple to complex internal as well as external surfaces.

Key Features

- Cost effective medium composition for nano-finishing of complex component’s internal/external surfaces

- Surface finishing of Al alloy/ SiC metal matrix composites.

- The average ‘out-of-roundness’ of AISI 4340 hard steel circular tubes is improved from 3.38 μm to 1.56 μm (i.e., 54% improvement) when finished with this medium.

- The single medium can be used for finishing of macro and micro holes/components.

Applications

- Medical industry: Finishing of knee joint, hip joint, heart valves etc

- Aerospace: Finishing of turbine blades, turbine blade turbulent holes etc

- Automobile: Finishing of fuel injector nozzles, engine cylinders, etc

- Deburring, radiusing and finishing of machined castings, and extrusion dies, etc

Polymer rheological abrasive medium and its self deformable properties when simply held with fingers

Contact: siic@iitk.ac.in
Nanoscience and Technology

A Process for Generating Micro and Sub Macro Patterns on the Surfaces or Layers of Polymers

Method for creating micro and sub micro sized physical relief patterns on soft solid surface layers at room temperature by pressure-less imprint method, where the deformation on the soft solid surface is predominantly elastic in nature

Key Features

- Direct patterning in solid state
- Deformation of the soft solid surface layer in conformal contact with the stamp leading to the pattern transfer is predominantly elastic in nature
- Use of a flexible patterned foil as the stamp for patterning, allowing excellent pressure less conformal contact and high fidelity pattern transfer
- No application of uniform external pressure for pattern transfer
- Possible to generate two dimensional ordered patterns by multiple imprinting

Applications

- Micro patterning of polymer surfaces for electronic and biomedical applications
- MEMS-Based Micro fuel cell systems for portable power applications
- Surfaces for nano-biotechnology applications like bio sensors, drug delivery etc.
Process for Synthesis of Nanocrystalline Hydroxyapatite

An efficient, inexpensive, low temperature and scalable process for synthesis of nanocrystalline hydroxyapatite through mechano-chemical route

Key Features

- The reaction milling process is carried out in single step

- The synthesis of nanocrystalline hydroxyapatite uses calcium hydroxide as calcium source powder and phosphorous pentoxide as phosphorous source powder is

- No external heat is applied during the process of reaction milling

- The reaction milling time for the synthesis of nanocrystalline hydroxyapatite is 1 hour

- The stoichiometric ratio of calcium hydroxide powder and phosphorous pentoxide powder is 1.74: 1

- Yield of hydroxyapatite is 99 %, no post milling treatment is necessary, average particle size is 50 nm or less can be obtained and phase control is achieved with relative ease

Applications

- Nanocrystalline hydroxyapatite can be used as a bone substitute material
- It can be used for drug delivery system
- It can be used as a medicine for calcium source

(a) Dula drive planetary ball mill.
(b) Transmission electron microscope image of nanocrystalline hydroxyapatite powder.
Ball Mill

Patent Filed

Indian Patent Application No:
1405/DEL/2012

Inventors:
Dr. B. K. Mishra
Dr. Sandeep Sangal
Dr. Ashish Garg
Mr. Tapendu Mandal
Department of Materials Science and Engineering

Mr. Prem Prakash,
Managing Director, Cenogen Materials

Co-assignee: Cenogen Pvt. Ltd.

Applications

- This new kind of ball mill can be a very attractive apparatus in the field of nano-materials, particulate material, high energy milling, mechanical alloying, pharmaceutical companies, powder metallurgy companies, automobile industries, cutting tool industries etc.

Key Features

- This invention describes a new apparatus called High Energy Variable Transmission Ratio Multi Tilt Planetary Ball Mill
- It consists of cylindrical containers evenly placed on the gyration arm.
- The containers rotate and revolve about different set of axes (Gyration axis, Jar axis and Jar rotation axis)
- Transmission ratio can be varied by varying the speed of jar and gyration arm independently
- Different tilting arrangements have been introduced, such as (a) Zero tilt, (b) Jar axis tilt, (c) Jar rotation axis tilt, (d) Both jar and jar rotation axis tilt, (e) Gyration axis tilt
- Different tilting combination increases randomization in ball movement and facilitate more homogeneous particle size distribution
- Controlling milling environment gives a better flexibility to mill different types of materials

Tilting arrangement of jar
Synthesis of Stable Nanocrystalline Iron Carbides by Reaction Milling in a Dual-Drive Planetary Mill

Patent Filed


Inventors:
Dr. B. K. Mishra
Dr. Sandeep Sangal
Mr. Debasis Chandra

Department of Materials Science and Engineering

Nanocrystalline titanium carbide (TiC) powders are synthesized from corresponding elemental constituent powders by reaction milling in a specially designed dual drive planetary mill at room temperature with any prior and post heat treatment

Key Features

- Percentage yield of titanium carbide is significantly more in lesser milling time
- Room temperature synthesis (no external heating source is required)
- Ultra-fine nanostructured powders can be prepared, (<10 micron)
- No atmosphere control during synthesis is required
- Process is economical, time efficient and scalable
- This synthesis process eco-friendly

Applications

- The material is extremely hard and can be used as good coating material for scratch proof and wear resistant coatings
- Potential coating material for coatings on tungsten carbide cutting tools

Contact: siic@iitk.ac.in

Bright field (BF) TEM micrograph and corresponding selected area diffraction pattern (SADP)
Carbon Nanotube and Nanoparticle Coated Carbon Fiber Reinforced-Polymer Hybrid Nanocomposite with Improved Thermomechanical Properties and a Process for Preparation thereof

Patent Filed

Indian Patent Application No: 1813/DEL/2005

Inventors:
Dr. Kamal K. Kar
Dr. Prashant Kumar
Dr. N.G. R. Iyengar
Mr. Prabhat Kumar

Departments of Mechanical Engineering, Aerospace Engineering & Materials Science and Engineering

Hybrid nanocomposite using polyester resin and nanoparticle-carbon-nanotube coated carbon fiber. This composite is more thermally stable, electrically conducting and shows significant improvement in modulus

Key Features

- Outstanding mechanical properties of carbon nanotubes are obtained (Young's modulus of ~1.25 TPa, and Tensile strength of ~100 GPa) in a structural hybrid composite
- Problem of dispersion in the matrix is avoided as carbon nanotube are need not to be added during fabrication
- Excellent thermal stability and mechanical properties are obtained

Applications

- Wide ranging applications from aerospace, automobiles, medical applications, heavy machinery, space materials, chemical, civil engineering industries, etc

Contact: siic@iitk.ac.in

IIT Kanpur Technologies | 6
A Functionally Graded Elastomer Nanocomposites (FGncs) and a Process for Preparation thereof

Patent Filed

Indian Patent Application No: 3125/DEL/2005

Inventors:
Dr. Kamal K. Kar
Mr. Ahankari Sandeep Suresh Rao

Material Science Programme

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Process to manufacture Functionally graded materials (FGMs) comprising of rubber/elastomer matrix, rubber chemicals and filler, through a simple and inexpensive technique to manufacture the same

**Key Features**

- Properties made to vary with outer and inner dimensions of the increasing or decreasing order
- 300% improvement in Young’s modulus with respect to the homogeneous nanocomposites is observed
- These have high mechanical strength, good weight ratio properties, good theromoformability and large-volume production capabilities

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**Applications**

- Composite manufacturing including polymer matrix like thermoplastic, ceramic matrix, carbon matrix, metal matrix, etc
- Applications are in automobiles, aircraft, spacecraft, sports, tires
- Bio-medical applications like flexible tubing for pacemaker leads, vascular grafts and catheters

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Comparison of functionally graded composite with uniformly dispersed composite with respect to the storage modulus.
A Method for Preparation of Nanoparticles Coated Carbon Fiber

Patent Granted

Indian Patent Application No: 3063/DEL/2005

Grant No: 250274

Inventors:
Dr. Kamal K. Kar
Mr. Prabhat K. Agnihotri
Departments of Mechanical Engineering & Materials Science and Engineering

Mr. Sanjay Dasgupta
(Group Director, ISRO)

Making of nano material coated carbon fibres. The coating of nanomaterial is done by cracking of metal oxide at specified temperature

Key Features

- Need not add nano materials during the fabrication of nanocomposites in the polymer matrix which is more difficult to disperse in the matrix
- Uniform distribution of nanoparticles is obtained
- Uniform coating of nanoparticles is obtained
- Significant improvement in thermal stability of nanoparticles
- It’s an insitu process

Applications

- The applications are wide range i.e., aerospace, automobiles, heavy machinery, space materials, chemical, civil engineering industries, etc

Contact: siic@iitk.ac.in
A Process for Preparation of Nanoparticles of Higher Molecular Weight of Polyethylene Polypropylene and Polystyrene

Patent Filed

Indian Patent Application No: 3161/DEL/2005

Inventors:
Dr. Kamal K. Kar
Mr. Prabhat K. Agnihotri

Departments of Mechanical Engineering, Materials Science and Engineering

Mr. Sanjay Dasgupta
(Group Director, ISRO)

Preparation of high molecular weight nanosized polystyrene, polypropylene and polyethylene. It focuses on multi component polymer system as a means of producing new material on the nanometer scale.

Key Features

- The particle size for polyethylene, polypropylene and polystyrene is 40 to 250, 25 to 200 and 10 to 50 nanometer respectively.

- The size of the polymers is in the nano range inspite of its high molecular weight.

- This technique is based on the control of thermodynamic parameters. Don’t need any surfactant, emulsifier, etc used in microemulsion process and cryogenic apparatus in other process.

- Yield of the process is very good (90 %)

Applications

- Polymer blends or alloys,
- Polymer powder spray coating,
- Polymer supported heterogenous catalysis
- Electo-optics and luminescent devices.

TEM micrographs of high molecular weight polymer nanoparticles
A Novel Viscoelastic Media used for a Nano-Finishing of Materials through Abrasive Flow Machining Process and a Method of Manufacture thereof

Patent Filed


Inventors:
Dr. Kamal K. Kar
Dr. J. Ramkumar
Mr. Piyushkumar B. Tailor

Department of Mechanical Engineering

Novel viscoelastic media for a nano-finishing of materials through abrasive flow machining process

Key Features

- The media is viscoelastic in nature
- The machining of heterogeneous material is carried out at nanoscale
- The new media has only three ingredients i.e., viscoelastic carrier(s), abrasive(s) and oil(s) that contributes to low cost and easy to customize
- The fabrication method is easy, fast, safe and environment friendly
- The media is useful for all types of existing abrasive flow machining processes

Applications

- Grinding, deburring, radiusing, leveling of surface, polishing, etc. on flat/contour/3D edge(s) features both on internal and external surfaces(s)

Contact: siic@iitk.ac.in
Carbon Nanotube(s) Coated Cutting Tool(s) and a Method of Preparation thereof

Patent Filed


Inventors:
Dr. Kamal K. Kar
Mr. Ariful Rahaman

Material Science Programme

Making and coating of carbon nanotubes on the tungsten carbide cutting tool. Having dense arrays of well-aligned carbon nanotubes on the tungsten carbide substrates

Key Features

- Simple dip coating technique has been used to coat catalyst on the cutting tool surface
- Carbon nanotube coating for cutting tools via chemical vapour deposition process results in superior properties
- Improvement in thermal conductivity because of the presence of carbon nanotube
- Uniform coating of nanotubes on the surface of cutting tool

Applications

- This futuristic carbon nanotube coated cutting tool can be used for the processing of machine steel, stainless steel, all cast iron, super alloys, aluminium alloys, non ferrous alloys and non metals, plastics, precious metal, lead alloys, copper, etc

Contact: siic@iitk.ac.in
Controlled Growth of Carbon Nanocones on Carbon Fiber(S)/Fabric and Method of Synthesis thereof

Process for uniform coating of carbon nanocones (CNCs) on long/short carbon fiber(s)/fabric using various transition metal catalyst

Key Features

- The invented nanocones arrays represent a high aspect ratio structure (~5μm long)
- The vertically aligned nanocones arrays have greater mechanical stiffness due to that, these nanocones can be used as nano syringes or dip-pen lithography tips
- Simple thermal chemical vapour deposition method is used to produce nanocones
- Single catalyst (transition metal) is used for the synthesis of nanocones

Applications

- In structural applications related to the areas in agriculture, aircraft and aerospace, corrosion resistant equipment, marine applications etc

Carbon nanocone coated fiber

Contact: siic@iitk.ac.in
Spherical Crystalline Nano Hydroxyapatite and Method of Manufacture from Calcium Oxide

Patent Filed

Indian Patent Application No: 1901/DEL/2008

Inventors:
Dr. Kamal K. Kar
Mr. Sumit Pramanik

Material Science Programme

Process for making a nano structured hydroxyapatite having fine pores

Key Features

- Perfectly spherical pure nano crystalline hydroxyapatite and nanoHAp are synthesised using primary route of preparation technique

- Cheapest raw material is used (CaO)

- Higher yield is obtained in the process

Applications

Biomedical Applications

- Bone implants
- Eye implants
- Drug Delivery
- Dental Implant
- Bio-prostheses etc

Spherical nanohydroxyapatite
Method of Manufacturing of Carbon Nano Tube Coated Glass Fiber/ Fabric and its Hybrid Nanocomposites

Patent Filed


Inventors:
Dr. Kamal K. Kar
Mr. Ariful Rahman

Material Science Programme

Process of preparation carbon nanotube coated glass fiber(s)/ fabric and its hybrid nanocomposites with improved thermomechanical and other properties

Key Features

- For the synthesis of CNTs, simple thermal CVD is used
- CNTs on glass fiber comprise high aspect ratio
- Dip coating process is used
- Suited for high temperature as glass transition temperature for this invention is higher
- The process is carried out at comparatively low temperature resulting in lower processing cost
- Better thermal stability electrical conductivity, higher strength, improved storage modulus is achieved

Applications

- Agriculture: silos and tanks
- Aircraft and aerospace: structural members
- Appliance & Business Equipments: covers, enclosures and fittings
- Corrosion resistant Equipments: linings, oil industry components

Modulus of CNT coated glass fiber reinforced nanocomposites

PatentFiled


Inventors:
Dr. Nishith Verma
Dr. Ashutosh Sharma

Department of Chemical Engineering

Methods for synthesizing a variety of carbon micro-nano-fibers based adsorbents and/or catalytic adsorbents that are related to the specific environmental remediation

Key Features

- Micron-size activated carbon fibers (ACF) as substrate used to grow carbon nanofibers (CNF)
- Provides especially designed and fabricated apparatus for impregnating ACF/CNF and for growing CNF by CVD

Applications

- Removal of recalcitrant solutes such as Pb, Hg, pesticides in industrial or agricultural effluents
- Control of emissions of gaseous pollutants such as SO2, and volatile organic compounds (VOC)
- Control of persistent organic pollutants, including chemical warfare agents (CWA)
- Recovery of protein and tetramycin from biofluids in pharmaceutical applications
- De-nitrification of potable water enriched with nitrogenous ions
**Nanocrystalline Titanium Carbide and Process of Preparation**

**Patent Filed**

**Indian Patent Application No:**
892/DEL/2010

**Inventors:**
Dr. B. K. Mishra
Dr. Sandeep Sangal
Mr. Debasis Chaira
Mr. Prem Prakash

**Department of Materials Science and Engineering**

**Nanocrystalline titanium carbide (TiC) powders are synthesized from corresponding elemental constituent powders by reaction milling in a specially designed dual drive planetary mill at room temperature with any prior and post heat treatment. Conventionally, titanium carbide powder is prepared by high temperature carbothermic reduction of titanium oxide by carbon powders and involves high energy requirements.**

**Key Features**

- Percentage yield of titanium carbide is significantly more in lesser milling time.
- Room temperature synthesis (no external heating source is required).
- Ultra-fine nanostructured powders can be prepared, (<10 micron).
- No atmosphere control during synthesis is required.
- Process is economical, time efficient and scalable.
- This synthesis process eco-friendly.

**Applications**

- The material is extremely hard and can be used as good coating material for scratch proof and wear resistant coatings.
- Potential coating material for coatings on tungsten carbide cutting tools.

*Bright field (BF) TEM micrograph and corresponding selected area diffraction pattern (SADP)*
A Method for Preparing Auto Capped Nano Particles such as CdS in Continuous Flow Columns

Patent Filed

Indian Patent Application No: 1395/DEL/2008

Inventors:
Dr. Rashmi Sanghi
Ms. Preeti Verma

FEAT Lab

An optimized “green” route to prepare auto capped CdS nanoparticles at room temperature using immobilized fungus Coriolus versicolor in continuous column mode with no external source of ‘sulphur’.

Key Features

- An optimized “green” route to prepare auto capped CdS nanoparticles with immobilized fungus Coriolus versicolor
- At room temperature
- In continuous column mode
- No external source of ‘sulphur’
- Dual purpose of both bioremediating cadmium as well as synthesizing stable CdS nanoparticles.
- Particles are characterized by FTIR, XRD, SEM, TEM, AFM, and PL.

Applications

- Solar cells, laser light-emitting diodes and photoelectric devices, in manufacturing of photoresitors (light dependent resistors) and many others

Contact: siic@iitk.ac.in
Carbon Nanocomposite Preparation and Uses thereof

Patent Filed


Inventors:
Dr. Sabyasachi Sarkar
Ms. Sharboni Ghoshal
Mr. Sumit Kumar Sonkar

Department of Chemistry

Nanocarbon based composite filter for low cost drinking water removing most of the pollutants

Key Features

- The composite filter traps arsenic, fluoride and other heavy metal salts
- It removes extra salinity from water
- It removes pesticides, hydrocarbon and organic molecules
- It also removes pathogenic microbes from water
- The filter is mainly based on nanocarbon materials with pore sizes 20 to 50 nm incorporated with certain functional groups and made composite with some other materials and can be synthesized readily at low cost to fit the rural economy

Applications

- This filter does not require extra energy and can be used in remote places without electricity and thus ideal for its rural use
- For trekking or for military operation in remote places portable cartridge type this filter can help to purify any available water to potable quality

Soluble arsenic, chloride, sulphate salts, other minerals and feces with pathogenic E.coli are trapped under filtering bed of ferric-oxide-CNT
**A Method of Fabricating a Dielectric Material with Enhanced Sensitivity**

*Patent Filed*

**Indian Patent Application No:** 1852/DEL/2010

**Inventors:**
Dr. Siddhartha Panda
Mr. Subham Datidar

*Department of Chemical Engineering*

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**Enhancing the sensitivity in electrolyte-insulator-semiconductor (EIS) based sensors**

**Key Features**

- A cost effective fabrication method for a dielectric material that enhances the sensitivity of an electrolyte-insulator-semiconductor (EIS) device

- The novelty lies in the tunable texturizing of the dielectric surface with nano-/meso particles. This enables improvement of the sensitivity

- The process fits into the semiconductor manufacturability processing scheme

- The design enables miniaturization

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**Applications**

- The device is a miniaturized pH meter capable of handling small volumes (~ microliters) which are not possible in conventional pH meters

- For analytical testing/detection: Pharmaceutical/biomedical, Chemical Process, Food/Beverage and Environmental Testing etc
Nanoparticles Loaded Polymer Capsules, Process for Synthesis and Application thereof

Patent Filed


Inventors: Dr. Sri Sivakumar Dr. Ashok Kumar Mr. Haider Sami

Departments of Chemical Engineering & Biological Sciences and Bioengineering

A general and versatile approach to prepare nanoparticles-loaded polymers capsules

Key Features

- The nanoparticles were prepared by templating polymer capsules as micro/nano reactors.

- These nanoparticles-loaded capsules will act as bioimaging agents (optical/MRI contrast agents) as well as drug delivery vehicles.

- The reactive group (-NH₂, -COOH and etc.) on the polymer can easily functionalized for targeted bio-applications

- A wide range of emission lines (450-1650 nm) can be achieved by doping with selected lanthanides.

Applications

- Pharmaceutical companies
- MRI imaging applications
An organic solar cell where the excitons are created in an organic semiconductor, but an electrostatically doped carbon nanotube film transports the charge carriers orthogonal to the

Key Features

- The exciton is created in the organic layer in the organic solar cells.
- The charge transport can take place in the carbon nanotube film.
- Built-in field created by ‘electrostatic doping’ of carbon nanotubes.

Applications

- A photovoltaic cell and a photo-detector
- Organic semiconductor films exhibiting high absorption in solar spectrum but with poor electrical conductivity may be used to build solar cells with this device architecture.
- Improved charge transport by the CNT film inorganic solar cells can be achieved.

The charges are transported along the CNT film due to the field induced in it by the electrodes with bias $V_1$ and $V_2$. 

Contact: siic@iitk.ac.in
It enables growing of carbon nanotube on the surface of carbon fiber to use outstanding properties of carbon-nano-tube i.e., Young’s modulus of ~ 1.25 TPa, tensile strength of ~ 100 GPa and thermal conductivity of 37,000 w/mk.

Key Features

- Unlimited length of substrate.
- Uniform coating and excellent modulus in composite structure is obtained.
- Length and diameter of carbon nanotube can be varied within the range 10-20000 nm and 1-60 nm respectively.
- In situ process with less production cost.
- High electrical conductivity is obtained.

Applications

- This new generation material has immense applications ranging from aerospace, automobiles, medical applications, heavy machinery, space materials, chemical, civil engineering industries, etc.
System and Method for Nanofinishing of a workpiece

An apparatus and method for nanofinishing of complex and freeform surfaces.

Key Features

- The finishing device is based on magnetorheological fluid
- A step-wise finishing is proposed to achieve nanofinishing on hard materials in minimum possible time
- A chemical based magnetorheological fluid is formulated to significantly reduce the surface roughness value
- The developed technology does not destroy the form geometry of the component to be finished.
- It utilizes flexible magnetorheological fluid brush which is self deformable

Applications

- Medical implants.
- Freeform optics
- Dies and molds.

Figure 1 (a) Photograph of MR finishing tool for freeform surfaces and (b) close view of MR polishing fluid (1 – CNC milling machine head, 2 – MR finishing tool, 3 – MR polishing flexible brush, 4 – fixture for knee joint implant, 5 – knee joint implant).
**Formation of Nanoporous Alumina Templates Using Polystyrene Microspheres**

Patent Filed

Indian Patent Application No: 2543/DEL/2013

Inventors:
Dr. Sarang Ingole
Mr. Rajib Halder
Mr. Bhaskar Dudem

Department of Material Science & Engineering

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**Patterning aluminum surface is an essential step in order to form a nanoporous alumina template with regularly arranged pores by anodic-oxidation of aluminum.**

**Key Features**

- A monolayer of self-assembled polystyrene microspheres is formed on the surface of a thin-film of aluminium which has been deposited on a desired substrate.
- The aluminium thin-film while having the above mentioned monolayer on its surface is anodically-oxidized in a high pH electrolyte to form barrier-type oxide.
- Monolayer is removed using appropriate solvent.
- The aluminium thin-film surface now has a pattern on its surface which is consisted of barrier-type alumina formed everywhere except the locations that were protected by the individual microspheres against anodic-oxidation.
- Such a patterned aluminium thin-film is again anodically-oxidized in a low pH electrolyte to form pores that begin to form right at the locations where no barrier-type alumina is present.
- In this way the patterned surface of aluminium thin-film ensures the formation of a nanoporous alumina template with regular array of pores in it.

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**Applications**

- Efficient management of a multi-level cache hierarchy in chip-multiprocessors running shared memory multi-threaded applications with co-operatively shared data such as database servers, web servers, etc..

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Figure 1. Scanning electron micrographs of (a) Surface of as-deposited aluminium thin-film on silicon; (b) A monolayer of self-assembled polystyrene microspheres on aluminium surface; (c) Patterned aluminium surface after anodic-oxidation where oxide formed everywhere except the locations protected by the individual microspheres against oxidation; (d) porous alumina with regularly arranged pores that are formed when the aluminium thin-film having pattern shown in the figure (c) is anodically oxidized. The inset shows irregularly arranged pores when aluminium thin-film was anodized without any pattern on its surface.
Directed Assembly of Tailored Multilayers of Nanoparticles (NPs) Using Click Chemistry

Patent Filed

Indian Patent Application No: 2169/DEL/2013

Inventors:
Dr. Sri Sivakumar,
Dr. Raj Ganesh S Pala
Dr. Ragina Ragan
Mr. Arun Prakash Upadhay

Department of Chemical Engineering

A general and versatile approach to fabricate the nanoparticles monolayer and tailored multilayers on any kind of substrate.

Key Features

- NPs mono/multilayers fabricated by alternative deposition of azide/alkyne modified nanoparticles on alkyne/azide modified substrates using click chemistry.
- NPs monolayer and multilayers are stable in different conditions (such pH, Temperature)
- NPs monolayers have excellent electrocatalytic activity and stability for methanol oxidation, water splitting and have excellent photocatalytic organic dye degradation
- NPs mono/multilayer fabrication requires mild reaction conditions (e.g. room temperature, mild solvents, and neutral pH), high yield, less or no by – product etc
- Invention provides the control over the multilayer formation which facilitates the fabrication of hybrid heterostructures for capturing wide solar spectrum.

Applications

- Photoelectrochemical water splitting, electrochemistry, catalysis etc.
- Biosensing, drug delivery, photonics.

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Process for Generation of a Nano-wrinkled Substrate and its Applications thereof

Patent Filed

Indian Patent Application No: 816/DEL/2013

Inventors:
Dr. Animangsu Ghatak
Dr. Anindita Sengupta Ghatak

Department of Chemical Engineering

A process for generation of novel nano-wrinkled patterned surfaces useful for a variety of phase transition operations e.g. controlled crystallization of small/macromolecules, condensation and boiling.

Key Features

- A simple, cost effective method for generating nano-wrinkle pattern on soft substrates.

- This process generates wrinkles having both large curvature, as large as 0.2 nm\(^{-1}\) and large distribution in curvature.

- The substrates are useful for heterogeneous nucleation, therefore, allow crystallization of protein molecules at low concentration in solution.

- The patterns are generated on environmentally benign substrates, e.g. poly(dimethylsiloxane) (PDMS), rubbers or soft gels.

Applications

- Crystallization of small molecules and macromolecules, boiling, condensation etc in which heterogeneous nucleation plays an important role.

- Facilitate screening of specific conditions for yet to be crystallized proteins and other types of molecules. Thus these substrates can be used as universal nucleant.

Contact: siic@iitk.ac.in
Piston Based Resistor

Patent Filed


Inventors:
Dr. A. Kushari
Dr. C. Venkatesan
Dr. C. S. Upadhyay
Mr. Sanjeev Kumar Gupta

Department of Aerospace Engineering

It deals with development of a device which measures vertical height. Developed device converts measured length into voltage signal. Then this acquired voltage can be reconverted into measured height with the help of calibration coefficient.

Applications

- Measurement of uni-dimensional displacement or pressure of surface profiles

Key Features

- The device is basically a variable resistance which varies against the movement of piston in either direction.
- Carbon granules were used as filler in between two conducting plates. The plates were kept inside an insulator cylinder.
- One piston is made stationary and other piston is allowed to move inside the cylinder (a restricted motion) to change the density of filler between the piston plates, which results in a changed resistance.
**Estimation of Inertia Tensor and Centre of Gravity of a Vehicle on the Three Axes Platform and a Test Rig used thereof.**

**Patent Filed**

**Indian Patent Application No:**
2365/DEL/2007

**Inventors:**
- Dr. C. Venkatesan
- Dr. C. S. Upadhyay
- Dr. Abhijit Kushari
- Mr. Sanjeev Kumar Gupta

**Department of Aerospace Engineering**

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**Estimation of the mini-helicopter inertia and centre of gravity location**

**Key Features**

- A three DOF test rig which has locking devices to lock any or all oscillatory motions. Three pairs of linear springs are used to retain the motions about the three axes.

- Natural frequencies were measured by employing Inertial Measurement Unit (IMU) which has two traits of accelerometer and rate-gyro.

- Least squares method is used to estimate the inertia and CG location of the mini-helicopter.

- The invention is simple in construction and efficient.

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**Applications**

- Automobile, Aerospace and Aviation industry.

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*Three axis test rig (Inertia estimation, Control law design and testing)*
An Arrangement for Jet Engine to Reduce Noise

Focuses on reducing the jet noise.

Key Features

- Implementation of high pressure differential in the case of turbofan engine with a high bypass ratio to bleed off a portion of bypass flow into the core flow

- The provision of bleeding a part of the bypass flow to the core flow results in a significant reduction in jet noise

- It constitutes “After Dilation” to make use of the pressure difference between the bypass and the core to mix a portion of the bypass air stream with the core flow, thus effectively mixing the flow and increasing the thrust

- “After Dilation” smoothen out the velocity profile, thus decreasing the velocity gradient and hence the jet noise, which contributes a large part to the engine noise

Applications

- For reducing the jet noise and improving the fuel efficiency of turbofan engines

- Potential scope of applicability in power generation using gas turbines

Contact: siic@iitk.ac.in
A Multipurpose Transporter with Modular Configuration

Patent Filed

Indian Patent Application No: 3157/DEL/2010

Design Patent No: 232708

Inventors:
Dr. J Ramkumar
Mr. Sathish Sekar

Department of Mechanical Engineering

A novel product has been developed where in the concept of modularity is integrated with bicycle (personalized bike) to suit the needs vendors at township, Institute campus, shop floors and various applications.

Key Features

- A Vehicle consist of three wheels, where in 2 are connected parallel in same horizontal axis and incorporated with a load carrier, handle for balancing and support the structure.

- And the joinery used for attaching and detaching the carrier is simple and easier in functioning.

- Options are given to the user to convert the pay loader into a normal bicycle for easy personalized biking.

- The detachable sub assembly can be specified according to the user application.

Applications

- A personal transportation device which could be transformed into a payload vehicle.

Modular transporter
The Drift-Battery Operated Campus Vehicle

Patent Granted

Indian Patent Application No: 234987

Inventors:
Dr. J. Ramkumar
Dr. Satyaki Roy
Mr. Sathish Sekar

Department of Mechanical Engineering

Key Features

- The Novelty resides in the surface ornamentation of the vehicle
- No claim is made by virtue of this registration in respect to any mechanical or other action of the mechanism whatever or in respect of any mode or principle of construction of the article

Applications

- Ecofriendly campus vehicle for Light mobility

Drift-Battery Operated Campus Vehicle
A Self Propelled Stair Climbing Wheel Chair

Patent Granted

Indian Patent Application No: 2097/DEL./2011

Design Patent No: 238758

Inventors:
Ms. Shanu Sharma
Dr. Shatarupa Thakur Roy
Dr. Satyaki Roy
Dr. J. Ramkumar
Mr. Sathish Sekar

Design Programme & Department of Mechanical Engineering

A convertible wheelchair designed to enable independent access for user in ascending and descending stairs and others obstacles like curbs

Key Features

- The invention is an economical, safe, user friendly and efficient stair climbing convertible manual wheelchair
- It is a simple machine designed for climbing stairs with mechanical benefit via lever ratchets system and braking system
- A “Y” shaped wheel is designed for better grip and optimum braking for climbing up and down
- An attempt is being made to fabricate and demonstrate a stair climbing manual wheelchair

Applications

- Wheelchair

The wheelchair configuration on steps in climbing position