C. Chandraprakash

Contact Information

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Department of Mechanical Engineering
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Research Interests

Thermomechanics based non-destructive evaluation, acoustic metamaterials, biomimetic design, instrumentation, and multifunctional thin films. In all these projects, I apply numerical techniques and mathematical models to understand experiments towards building products.

Education

Doctor of Philosophy in Engineering Science and Mechanics — Aug 2011 - Feb 2017
Pennsylvania State University, University Park, PA, USA

- Dissertation: Multifunctional Parylene-C microfibrous thin films
- Advisors: Prof. Osama O. Awadelkarim, Prof. Akhlesh Lakhtakia

Bachelor and Master of Technology in Mechanical Engineering — Aug 2005 - May 2010
Specialization: Product Design Minor: Industrial Engineering
Indian Institute of Technology Madras, Chennai, India

- Dissertation: Modeling thermomechanical response of stainless steel subjected to monotonic tensile and cyclic loading
- Advisors: Prof. Krishnan Balasubramaniam, Prof. Krishnamurthy Chitti Venkata

Academic and Research Experience

Assistant Professor — Dec 2017 - present
Indian Institute of Technology Kanpur, India

Visiting Assistant Professor — Oct 2017 - Dec 2017
Indian Institute of Technology Kanpur, India

Research and Teaching Assistant — Aug 2012 - Apr 2017
Pennsylvania State University, University Park, USA

Project Officer & Research Assistant — May 2008 - Jul 2010
Center for Non-Destructive Evaluation, Indian Institute of Technology Madras, India

Sponsored research

1. Soft acoustic metamaterials: Fabrication, computation, and instrument development. Rs. 36 Lakhs. Sponsor: SERB (under ECRA scheme). 2019-2022. (PI)
2. Multisensor characterization of solid materials for non-destructive evaluation. Rs. 22 Lakhs. Sponsor - IIT Kanpur (under Initiation grant). 2018-2021. (PI)

Consultancy

1. Study and validation of technical task 227 & 214 recommended by OEM & identification of alternate NDE for in-situ detection of corrosion in fin of MIG-29 AC at 11 BRD, Air Force. Rs. 35 Lakhs. Sponsor: Air Force. 2019-2021. (Co-PI)
2. Silicon carbide coating on carbon-fiber fabric. Rs. 3.5 Lakhs. Sponsor: L & T Defense. 2018. (Co-PI)
3. Mechanical and thermal properties of enclosure materials of an optical cable. Rs. 1 Lakhs. Sponsor: Sterlite. 2018. (Co-PI)

Journal Publications

1. C Chandraprakash, V C Venugopal, A Lakhtakia, and O O Awadelkarim. Long-wavelength infrared characteristics of multifunctional microfibrous thin films of Parylene C, *Microwave Optics and Technology Letters*, 61 (9), 2206–2209 (2019).

2. C Chandraprakash, C V Krishnamurthy, and K Balasubramaniam. Thermomechanical phenomenon – A non-destructive evaluation perspective, *Transactions of the Indian Institute of Metals*, 72 (11), 2905–2915 (2019).
3. I H Khawaji, C Chandraprakash, O O Awadelkarim, and A Lakhtakia. Selectablity of mechanical and dielectric properties of Parylene-C columnar microfibrous thin films by varying deposition angle, *Flexible and Printed Electronics*, 2 (4), 045012 (2017).
4. C Chandraprakash, A Lakhtakia, and O O Awadelkarim. Parylene-C microfibrous thin films as phononic crystals, *Journal of Micromechanics and Microengineering*, 27 (7), 075012 (2017).
5. I H Khawaji, C Chandraprakash, O O Awadelkarim, and A Lakhtakia. Dielectric properties of and charge transport in columnar microfibrous thin films of Parylene C, *IEEE Transactions on Electron Devices*, 64 (8), 3360-3367 (2017).
6. C Chandraprakash, A Lakhtakia, N R Brown, W Orfali, and O O Awadelkarim. Temperature-dependent dynamic mechanical moduli of microfibrous columnar thin films of Parylene C, *Polymer Testing*, 53, 89–97 (2016).
7. C Chandraprakash, A Lakhtakia, and O O Awadelkarim. Reply to comment on surface energy of Parylene C, *Materials Letters*, 166, 325–326 (2016).
8. C Chandraprakash, A Lakhtakia, O O Awadelkarim, and W Orfali. Relative permittivity of bulk Parylene-C in the infrared regime, *Journal of Electromagnetic Waves and Applications*, 29 (16), 2139–2146 (2015).
9. C Chandraprakash, A Lakhtakia, and O O Awadelkarim. Surface energy of Parylene C, *Materials Letters*, 153, 18–19 (2015).
10. C Chandraprakash, N M Wonderling, A Lakhtakia, O O Awadelkarim, and W Orfali. Microfiber inclination, crystallinity, and water wettability of microfibrous thin-film substrates of Parylene C in relation to the direction of the monomer vapor during fabrication, *Applied Surface Science*, 345, 145–155 (2015).
11. Y Xie, C Chandraprakash, N Nama, S Yang, M Lu, Y Zhao, J D Mai, F Costanzo, and T J Huang. Exploring bubble oscillation and mass transfer enhancements in acoustic-assisted liquid-liquid extraction with a microfluidic device, *Scientific Reports*, 5 (12572), (2015).
12. C Chandraprakash, A Lakhtakia, N R Brown, W Orfali, and O O Awadelkarim. Frequency- and temperature-dependent storage and loss moduli of microfibrous thin films of Parylene C, *Materials Letters*, 116, 296–298 (2014).
13. C Chandraprakash, A Lakhtakia, O O Awadelkarim, and W Orfali. Acoustic scattering from microfibers of Parylene C, *Journal of Applied Physics*, 116 (13), 134905 (2014).
14. C Chandraprakash, N Nama, M I Lapsley, F Costanzo, and T J Huang. Theory and experiment on resonant frequencies of liquid-air interfaces trapped in microfluidic devices, *Journal of Applied Physics*, 114 (19), 194503 (2013).
15. C Chandraprakash, C V Krishnamurthy, K Balasubramaniam, and R V Prakash. Thermomechanical response of metals: Maxwell vs. Kelvin–Voigt models, *Materials Science and Engineering: A*, 560, 54–61 (2013).

Conference Proceedings

1. I H Khawaji, C Chandraprakash, W Orfali, A Lakhtakia, and O O Awadelkarim. Electrical studies on Parylene-C columnar microfibrous thin films, *The Electrochemical Society*, Phoenix, USA, 69 (5), 113–119 (October 2015).
2. M I Lapsley, D Ahmed, C Chandraprakash, F Guo, M Lu, L Wang, and T J Huang. Monitoring acoustic bubble oscillations with an optofluidic interferometer, 16^{th} *International Conference on Miniaturized Systems for Chemistry and Life Sciences*, Okinawa, Japan, 1906–1908 (October 2012).
3. R V Prakash, K Thiyagarajan, C Chandraprakash, and K Balasubramaniam. Thermographic evaluation of SS 304 material during monotonic loading, *ASME 2009 International Mechanical Engineering Congress and Exposition: Processing and Engineering Applications of Novel Materials*, Florida, USA, 14, 183–187 (November 2009).

Conference Presentations

1. V. Sharma, VRS. Raju, S. Amit, and C Chandraprakash. Ultrasonic TOFD and guided waves for corrosion detection in a multilayer structure, accepted for 20^{th} *World Conference on NDT (WCNDT)*, Seoul, South Korea (June 2020).
2. I H Khawaji, C Chandraprakash, O O Awadelkarim, and A Lakhtakia. Engineering the dielectric and mechanical properties of Parylene-C columnar microfibrous thin films by controlling the deposition angles, *Materials Science & Technology: Advances in Dielectric Materials and Electronic Devices*, Pittsburgh, USA (October 2017).
3. C Chandraprakash, A Lakhtakia, and O O Awadelkarim. Charge-storage and absorption characteristics of Parylene-C columnar thin films, *Center for Dielectric and Piezoelectrics, Spring Meeting*, University Park, USA (April 2017).
4. C Chandraprakash, N M Wonderling, A Lakhtakia, O O Awadelkarim, and W Orfali. Columnar multifunctional microfibrous Parylene-C thin films: Microfiber inclination, crystallinity, and water wettability, *Materials Research Symposium: Multifunctionality in Polymer-Based Materials, Gels and Interfaces*, Boston, USA (December 2015).
5. I H Khawaji, C Chandraprakash, W Orfali, A Lakhtakia, and O O Awadelkarim. The effects of morphology on the dielectric and mechanical properties of Parylene-C microfibrous thin films, *The Electrochemical Society*, Cancun, Mexico, no. 11, 683–683 (October 2014).
6. C Chandraprakash, N R Brown, O O Awadelkarim, W Orfali, and A Lakhtakia. Mechanical properties of microfibrous films of Parylene C for acoustic applications, *Materials Science & Technology: Mechanical Behavior of Technological Coatings and Thin Films – Relating Synthesis, Structure, and Mechanical Property Relationships*, Pittsburgh, USA (October 2014).

Other publications

1. Ph.D. thesis: Multifunctional Parylene-C microfibrous thin films, Pennsylvania State University (February 2017).
2. Book review: Fourier modal method and its applications in computational nanophotonics, Journal of Nanophotonics, 7 (1), 9898 (2013).

Invited Talks

1. Plane-wave expansion method for multifunctional metamaterials, QIP Short Course on "Electromagnetic Metamaterials: Microwave-Infrared-Optical Applications" in IIT Kanpur, Uttar Pradesh, India, August 2019.
2. Multifunctional metamaterials of Parylene C, Millersville University, Pennsylvania, USA, March 2017.

Teaching Experience

Instructor, Mechanical Engineering, IIT Kanpur — Jan 2018 - present

- ME698E – PG & UG – Fabrication and mechanics of thin films (new modular course)
- ME621A – PG – Introduction to solid mechanics (Theory of elasticity)
- ME723A – PG – Wave propagation in solids
- ME222A – UG – Nature and properties of materials

Tutor, Mechanical Engineering, IIT Kanpur — Jan 2018 - present

- ME351A – UG – Design of machine elements
- ESO202A – UG – Mechanics of solids (Strength of materials)
- ESO209A – UG – Dynamics

Distinguished Teaching Fellow, College of Engineering, Penn. State

- E MCH 211 – Statics — Spring 2016

Teaching Assistant, Engineering Science and Mechanics, Penn. State

- E SC 211, 212, 213, & 214 – Nanotechnology — Summer 2016
- E MCH 315 – Mechanical response of materials — Fall 2011 and Spring 2012
- E MCH 211 – Statics — Spring 2015
- E MCH 212 – Dynamics — Fall 2016
- E SC 400, 404H – Part time — Spring 14 - Spring 2016

PhD Thesis supervision

- Sandeep Kumar Karn (joined Aug 2018)
- Mukul Kumar Srivastava, co-advised by Prof. Sumit Basu (joined Jan 2019)

Masters Thesis supervision

- Vishal Sharma – MS (joined Aug 2018)
- Zishan Ali Khan – MS (joined Aug 2018)
- Goutham Sankar – Part-time M. Tech (joined Aug 2018)
- Jishal S. Rahim – M. Tech (joined Aug 2019)
- Nasikh Rahman – M. Tech (joined Aug 2019)
- Nikhil Ahuja – M. Tech (joined Aug 2019)

Graduated

- Surendra Kumar Dorwal – M. Tech 2019 – Forbes
- Pushpendra Singh – M. Tech 2019 – EXL Services

Non-thesis supervision

In progress

- Manan Agarwal – SERB ECRA (joined Sep 2019)
- Karan Ahuja – TEQIP Supported (joined Jan 2020)

B. Tech Projects: ME451 & ME452

- 2018-19: Rahul Shekar, Abhinav Thakur, and Rajesh Mishra.
  Title: Design and development of a street sweeping machine
- 2019-20: Pinaki Shaw and Prateek Sharma.
  Title: A growable soft robot to clench and move weights

Computational Skills

MATLAB, Shell scripting, COMSOL, C, Scheme, Mathematica

Technical Skills

Fabrication: Fibrous and conventional Parylene C chemical vapor deposition, 4 years experience in class 1000/100 cleanroom and dealing with vacuum systems

Characterization: SEM imaging, Profilometry, C-D and dielectric breakdown, Dynamical mechanical analysis, Infrared spectroscopy – ATR and Transmission, X-Ray diffraction – WAXS, Contact angle measurements, Bulk mechanical testing, Infrared thermography, Energy dispersive spectroscopy

Hands-on experience in laboratory and field

Awards and Honors

1. Paul A. Lester Memorial Award for best PhD research in microelectronics in Department of Engineering Science and Mechanics, Penn State University 2017
2. Distinguished Teaching Fellow in College of Engineering, Penn State for 2015-16
3. Won 3rd prize for poster presentation in *ESM Today*, graduate research symposium of Department of Engineering Science and Mechanics, Penn State University 2017
4. Won 2nd prize for poster presentation in *ESM Today* 2013
5. Won Project-X, a hands-on design competition in *WAVES* – Technical festival of Department of Naval Architecture and Ocean Engineering, IIT Madras 2008
6. Recipient of Merit cum Means award from IIT Madras 2005-09
7. Secured 132nd rank among 2,00,000 students in Graduate Aptitude Test Examination 2008
8. Secured 143rd rank among 4,50,000 students in All-India-Engineering-Entrance-Examination 2005

Co-curricular activities

1. Examiner for MS and M. Tech theses from AE, ChemE, EE, ME, and MSE, and PhD theses of ME and MSE
2. Reviewer for journals: Materials Letters, Sadhana, Applied Surface Science, and Physical Chemistry Chemical Physics, College of Engineering Research Symposium 2015 (Penn State)
3. Student member of 'Material Advantage Program (TMS, ACerS, AIST, ASM)' for 2014–17
4. Member of 'The Materials Research Society' for 2015–17

Administrative activities

1. Outreach: Demonstrated acoustic measurements and presented poster to high school students as part of Science Open House, IIT Kanpur 2020
2. Seminar coordinator in Mechanical Engineering 2019-20
3. Anchor for Golden Jubilee Institute Foundation day 2018
4. Co-organized EC Subbarao lecture in MSE, IIT Kanpur 2018
5. Judge for: Student awards (2018), Techkriti competitions (2018 & 19), Smart India Hackathon (2018 & 19), and Project Scientist (2018 & 19)
6. President (Aug'13 - May'14) and Vice-President (Aug'14 - May'15) Engineering Science and Mechanics Graduate Student Council, Penn State

Industrial Experience

Technical Manager in Noise Vibration Harshness department — Sep 2010 - Jul 2011
Engineering Research Center, Tata Motors Ltd., Pune, India

- Quantitative analysis for noise and vibration characteristics of small commercial vehicles
- Developed technical reports, presentations, and proposals for field and external collaborations

Internship Trainee — May 2008 - Jul 2008
Engineering Design Centre, Caterpillar India Private Ltd., India

- Designed anti-toppling mechanisms and developed stability criteria for shop floor structures
- Performed 'Value Stream Mapping' for the Virtual Manufacturing Engineering group