

Institute Lecture

Graphene Analogues

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26th June 2016, Time: 6 PM, Venue: Outreach Auditorium

Abstract

Graphene has been a sensational discovery of recent years. In the last two to three years, there has been effort to prepare graphene-like layered inorganic materials such as MoS₂, WS₂, GaS and BN. Several methods of synthesis of such nanosheets have been developed.¹ In the last two years MoS₂ and related dichalcogenides have gained considerable importance because of the many novel properties and phenomena exhibited by them.² Transistors and devices have been fabricated with some of these layered inorganic materials. A new family of graphene-like materials is the borocarbonitrides, (B_xC_yN_z). These materials exhibit unusual gas adsorptive properties including high-surface areas.³ Open-framework materials incorporating graphene and BN have been synthesized and characterized. These materials also show gas adsorptive characteristics.⁴ The graphene-like 2D materials have potential applications specially in energy devices⁵.

1. C.N.R. Rao, H.S.S.R. Matte, U. Maitra, *Angew. Chem. Int. Ed.* **52**, 13162 (2013).
2. C.N.R. Rao and U. Maitra, *Chem. Phys. Lett.* (Frontiers article) **609**, 172 (2014).
3. N. Kumar, K. Moses, K. Pramoda, S.N. Shirodkar, A.K. Mishra, U.V. Waghmare, *J. Mater Chem.* (Perspective) **A1**, 5806 (2013).
4. R. Kumar, D. Raut, I. Ahmed, U. Ramamurthy, T. Maji and C.N.R. Rao, *Mater. Horizons*, **1**, 513 (2014).
5. C.N.R. Rao, K. Gopalakrishnan and U. Maitra, *ACS Appl. Mater. Interfaces* (Spot Light), **7**, 7809 (2015).

About the speaker

Prof. Chintamani Nagesa Ramachandra Rao was born on June 30, 1934 in Bangalore. He completed his M.Sc. in 1953 from Banaras Hindu University and Ph.D. in 1958 from Purdue University and then became a research chemist at the University of California at Berkeley. He returned to India in 1959 to work as a lecturer at the Indian Institute of Science, Bangalore. He was a Professor of Chemistry at IIT Kanpur from 1963-76, Head of the Department of Chemistry from 1963-1966, and also the Dean of Research & Development from 1968-1971. He moved back to IISc Bangalore in 1977 as the Founder Chairman of Solid State and Structural Chemistry Unit and Materials Research Laboratory. Subsequently, he became the Director of IISc in 1984 and remained so till 1994. He was the founder president of Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore. Apart from IITK, IISc and JNCASR, he has also taught at some of the best known universities in the world as visiting professor. The list includes the University of Oxford, University of California Berkeley, University of California Santa Barbara, Purdue University, Universite Joseph Fourier at Grenoble, University of Cambridge and many others.

Some of the major areas of research of Prof. Rao include transition metal oxides and other extended inorganic solids, inorganic-organic hybrid materials, nanomaterials including nanotubes, graphene and other two dimensional systems, and artificial photosynthesis and hydrogen generation by photocatalysis and thermal means. He also takes huge interest in science education and direct contact programmes with school children. Prof. Rao has more than 1600 research publications and 50 books against his name. He is in the Editorial board of more than 20 international journals dealing with Chemical Physics, Spectroscopy, Solid State and Materials Chemistry.

Professor Rao is a Fellow or Foreign Member of all major scientific organizations in the world. To name some of them, Prof. Rao is a Fellow of all three Science Academies in India. He is a foreign member of the US National Academy of Sciences, American Academy of Arts and Sciences, American Philosophical Society, French Academy of Sciences, Russian Academy of Sciences and also he is a Fellow of the Royal Society (London). He was the founder President of Chemical Research Society of India and also the Materials Research Society of India. He was the Chairman of the Science Advisory Council to the Prime Minister for 2004 – 2014. He also held the position of President of Indian Academy of Sciences and Indian National Science Academy and many other major science organizations. He was the Chairman of Board of Governors of IIT Kanpur from 2003 to 2006.

Prof. Rao is the recipient of a huge number of national and international awards. The list includes the Shanti Swarup Bhatnagar Prize in 1968 from CSIR, Government of India, Albert Einstein Gold Medal of UNESCO in 1996, The Dan David Prize for Science in 2005, The Royal Medal by the Royal Society, London in 2009, and many others. He received Padma Shri in 1974, Padma Vibhushan in 1985 and then Bharat Ratna, the highest Civilian Award of India, in 2014.

Prof. Rao has received honorary doctorates from close to 70 universities all over the world which includes a D.Sc. (honoris causa) from IIT Kanpur in 2016.

Tea at 5:45 PM

All interested are welcome.

Amalendu Chandra
Dean of Research and Development, IIT Kanpur