Nanoscopic Inorganic Structures – A New Class of Materials for Sustainability

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The discovery and development of periodic porous materials of well-defined pore geometry with precise and easily controllable pore shape and size is of great importance in many areas of modern science and technology. In this regard, mesoporous and hierarchical (micro-meso-macro) molecular sieves including zeolite-like metal-organic framework structures (MOFs) are the new generation ordered porous solids, analogous to conventional microporous (zeolitic) materials, with high surface area, large pore opening and huge pore volumes. On the one hand, the unique flexibility of these materials, in terms of synthetic conditions, pore size tuning, high surface area, large internal hydroxyl groups, framework substitution, etc., have created new avenues not only in catalysis but also in the areas of advanced energy materials and environmental pollution control strategies. On the other hand, the preparation and characterization of high quality materials with well-defined pore characteristics is of paramount importance for many applications in areas including nanomaterials, catalysis, adsorption and separation. In designing such materials, several characteristics of pore structure may be addressed, which include their shape, size, pore interconnectivity, etc. Likewise, traditional preparation methods of supported catalyst systems are neither efficient in generating/dispersing uniform sized clusters nor chemically inert towards the guest molecules. Nevertheless, the confinement of nanoclusters/nanofilaments/enzymes in the cavities/voids/pores of nanostructured matrices is attracting much attention as a way to stabilize highly dispersed materials in the form of atoms, clusters, colloids or filaments, and prevent their coalescence into to larger, ill-defined aggregates. In this context, self-assembly of nanoparticles into ordered pore structures, i.e., encapsulation of the nanosized materials in zeolitic-pores, is considered as one of the promising options. Therefore, in this presentation, the recent progress on the development of numerous nanoscale materials and their applications in catalysis will be discussed.

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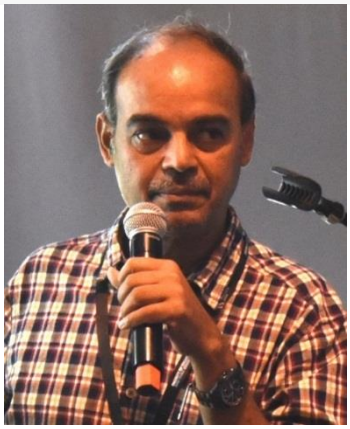
Speaker Biography



Dr. Parasuraman Selvam is currently Head, National Centre for Catalysis Research, IIT-Madras, Chennai, and Professor in the Department of Chemistry, IIT-Madras, Chennai; Adjunct Faculty, School of Chemical Engineering and Analytical Science, The University of Manchester, Manchester, United Kingdom, and Department of Chemical and Process Engineering, University of Surrey, Guildford, United Kingdom.

Earlier, Prof. Selvam was a Faculty at IIT-Bombay, Mumbai and Tohoku University, Sendai, Japan. He was also a Visiting Associate Professor, School of Chemical Engineering, The University of Queensland, Brisbane, Australia, and an Eminent International Visitor, School of Science and Health, Western Sydney University, Penrith, Australia. Prior to these, Prof. Selvam was a Research Associate in the Department of Condensed Matter Physics, and Laboratory of X-ray Crystallography, University of Geneva, Geneva, Switzerland.

Prof. Selvam's research work mainly involves in the development of novel synthetic procedures for the preparation of ordered nanoporous (zeolitic) materials such as silicas, aluminas, titanias, carbons, metallo-silicates, meallo-aluminates, and a variety of other metal oxides including ceria, zirconia, etc. In addition, Prof. Selvam is also involved in the development of highly organised and hierarchically porous materials, size- and shape-controlled nanomaterials as well as supported metal catalyst systems.

Prof. Selvam's research interests also include nanostructured materials, heterogeneous catalysis for green chemical routes, environmental remediation processes, and energy conversion (biomass, solar hydrogen) and storage (methanol fuel cell, lithium-ion battery) methods. His major contribution also includes in the design and development of novel heterogeneous catalysts for a variety of industrially important organic transformations which have received overwhelming response both from industry and academia. Several industrial consultancies and sponsored projects that he has brought to the Institute has helped him to build a strong and vibrant catalysis research group at IIT-Madras.

Prof. Selvam held several visiting/adjunct faculty positions in various Universities/Institutes both in India and Abroad. He has also been bestowed with several national and international awards and honours. Prof. Selvam has published over 275 original research papers and co-inventor of about 25 patents. Prof. Selvam held several visiting/adjunct faculty positions in various Universities/Institutes both in India and Abroad. He has also been bestowed with several national and international awards and honors. For details see: https://www.iitm.ac.in/info/fac/selvam