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Engineering at the Nanoscale: Route to Applications and Challenges

Abstract: The talk will focus on approaches used to engineer materials at the nanoscale for various applications in future technologies. In particular, the case of carbon nanostructures will be used to highlight the challenges and progress. Various organized architectures of nanotubes and graphene can be fabricated using relatively simple processes and the work in attaining control on the directed assembly of these structures will be discussed. Some of these structures offer excellent opportunity to probe novel nanoscale behavior; however, when it comes to engineering such materials into precise architectures, challenges remain. We have pursued several novel applications for these materials, taking into account their multifunctional properties. Some of these promising applications of these low-dimensional carbon materials and their hybrids will be discussed from the perspective of what has been accomplished in recent years. Our efforts on the strategies of growth and manipulation of nanomaterials and some of our recent successes in controllably fabricating heterogeneous and complex nanostructures will be highlighted.

Biography: Professor Pulickel Ajayan earned his B. Tech in metallurgical engineering from Banaras Hindu University in 1985 and Ph.D. in materials science and engineering from Northwestern University in 1989. After three years of post-doctoral experience at NEC Corporation in Japan, he spent two years as a research scientist at the Laboratoire de Physique des Solides, Orsay in France and nearly a year and a half as an Alexander von Humboldt fellow at the Max-Planck-Institut fur Metallforschung, Stuttgart in Germany. In 1997, he joined the materials science and engineering faculty at Rensselaer as an Assistant Professor and was the Henri Burlage chair Professor in Engineering until 2007. He joined the mechanical engineering and materials science department of Rice university, as the Benjamin M. and Mary Greenwood Anderson Professor in Engineering from July 2007. Professor Ajayan's research interests include synthesis and structure-property relations of nanostructures and nanocomposites, materials science and applications of nanomaterials and phase stability in nanoscale systems. He is one of the pioneers in the field of carbon nanotubes and was involved in the early work on the topic along with the NEC group. He has published one book and 350 journal papers with more than ~23,000 citations and an h-index of 77. He has given more than 250 invited talks including several keynote and plenary lectures in more than 20 countries. Ajayan has received several awards including the Senior Humboldt Prize, 2006 MRS medal, Scientific American 50 recognition in 2006, RPI senior research award (2003), the Burton award from the microscopic society of America (1997) and the Hadfield medal for the outstanding metallurgist in India (1985). He has been elected as a fellow of AAAS and to the Mexican Academy of Sciences. He is on the advisory editorial board of several materials science and nanotechnology journals and on the boards of several nanotech companies.