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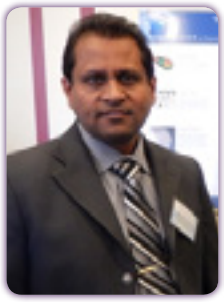

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Towards developing energy efficient systems based on novel carbon materials

Minimizing friction and wear-related mechanical failures remains as one of the greatest challenges in today's moving mechanical systems leading to a search for new materials that can reduce friction and wear related energy losses and the understanding of fundamental mechanisms that control friction. In this context, our work on graphene has shown that this materials properties can be manipulated at the atomic level to achieve exceptionally high wear resistance, as well as, achievement of super lubricity (or near zero friction) at macroscale through combined use of graphene and nanodiamonds on sliding surfaces. This discovery presents a paradigm shift in understanding frictional behavior of graphene and other 2D materials and offers a direct pathway for designing energy efficient frictionless tribological systems. In the second part of my talk, I'll describe our recent work on direct growth of wafer-scale graphene on diamond. The fact that the one atom thick graphene membrane strongly affected by the substrate interactions puts limit on exploiting excellent intrinsic properties of graphene for various applications. Diamond offers multiple unique properties, such as high phonon energy, low trap density, and high thermal conductivity, which makes it an ideal substrate for fabricating graphene devices on diamond. We demonstrate a novel process to grow large area single and few layer graphene directly on the diamond thin film deposited on silicon wafer thus eliminating the need for graphene transfer. This approach offers new opportunities for developing graphene based nanoelectronic devices directly on dielectric substrate (diamond/Si) and provides reliable, efficient and low cost alternative as compared to current methods.

Biography

Anirudha V Sumant is a Materials Scientist working at Center for Nanoscale Materials, Argonne National leading the research on nanocarbon materials including CVD-diamond, carbon nanotube and graphene. He has more than 22 years of research experience in the synthesis, characterization and developing applications of carbon based materials. His main research interests include electronic, mechanical and tribological properties of carbon based materials, surface chemistry, micro/nano-scale tribology, and micro-nanofabrication. He is the author and co-author of more than 100 peer reviewed journal publications, 2 book chapters, winner of four R&D 100 awards, NASA Tech Brief Magazine Award, 2016 TechConnect National Innovation Award, has 16 patents granted, and 15 pending and has given numerous invited talks. His research in diamond materials helped in the formation of several start-up companies including NCD Technologies Inc. and AKHAN Semiconductors Inc. He is a member of MRS, STLE and AVS.

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