CHEMISTRY/PHYSICS SEMINAR SERIES

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11:00 a.m. to 11:50 a.m. in ENW 115

Ultrafast scalable manufacturing of 2D nanomaterials using supersonic flows

ABSTRACT

Two-dimensional (2D) nano-materials, such as Graphene, Boron Nitride and Molybdenum Disulfide, are finding numerous applications in next generation electronics, composites, consumer goods, energy generation and storage, and healthcare. However, their true potential will not be realized unless cost-effective, high-throughput and defect-free techniques for their mass-synthesis are developed. In this presentation, I will detail our recently developed method, known as compressible flow exfoliation (CFE), for producing 2D nano-materials using a multiphase flow of layered materials suspended in a high pressure gas undergoing supersonic expansion within confined geometries. The expanded gas is sprayed in a suitable solvent, where a significant portion of the material is found to be exfoliated to a few layers per particle. This method has significant benefits over the existing 2D material exfoliation methods like chemical intercalation and liquid phase exfoliation. The most obvious advantage is the fast, continuous nature of the CFE process with residence times on the order of 100µs. Furthermore, the process is environmentally friendly, has a reduced occurrence of defects and has the versatility to be applied to any 2D layered material (graphene, boron nitride and molybdenum disulfide) using any high pressure gas. If implemented on an industrial level, we estimate the CFE process could reduce 2D materials costs by an order or magnitude or more

BIOGRAPHY

Reza Rizvi

Reza Rizvi is an associate professor of Mechanical Engineering at York University. His research interests are in scalable nano-manufacturing of polymer and inorganic composites, structures and surfaces. Reza obtained his PhD from the Department of Mechanical and Industrial Engineering at the University of Toronto and held an NSERC postdoctoral fellowship at the Chemistry Department at the University of California, Los Angeles (USA), and a TVN postdoctoral fellowship at the Toronto Rehabilitation Institute. From 2016-19, Reza was an assistant professor at the University of Toledo in Toledo (USA). His previous works include developing flexible pressure sensing nanocomposites, developing fully bio-based green composites for automotive industry, and consulting to the automotive industry for environmental testing of automotive rubber and plastics. Reza's work has been presented and invited in several international conferences, has been funded by the National Science Foundation (NSF), National Aeronautics and Space Agency (NASA), NSERC, Mitacs, Canada Foundation for Innovation (CFI) and has been published in reputable journals such as Advanced Materials and ACS and AIP publications.