Short Abstract

Atomic 2D materials such as graphene and transition metal dichalcogenides offer unique properties driven by dimensional scaling, including enhanced electronic, mechanical, and chemical behaviors. This presentation details the fundamental exploration of atomically-thin materials, highlighting pioneering investigations and translational approaches aimed at addressing pressing challenges in computing, healthcare, and sustainability.

Full Abstract

Adventures at the Atomic Scale: Scaling for Neuromorphic Systems, Wearables & Clean Energy

Atomic 2D materials such as graphene and transition metal dichalcogenides offer unique properties driven by dimensional scaling, including enhanced electronic, mechanical, and chemical behaviors. Their ultrathin nature fosters improved quantum transport and surface-driven phenomena that can boost device performance beyond conventional materials. In computing, 2D-based resistive switching devices promise high-density, low-energy neuromorphic systems, and novel opto-electronic functionalities. Their flexibility, giant surface to volume ratio, and biocompatibility also enable wearable sensors for continuous, unobtrusive health monitoring. Furthermore, atomic nanolayers are being explored for ion exchange membranes in fuel cells, where they reduce crossover losses and enhance ionic conductivity, pointing to more efficient clean energy systems.

This presentation details our recent advances in the fundamental exploration of atomically-thin materials, highlighting pioneering investigations and translational approaches aimed at addressing pressing challenges in computing, healthcare, and sustainability.