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Van der Waals heterostructures: fabrication and materials issues

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Abstract

Artificial *van der Waals heterostructures* of two-dimensional materials offer the possibility of creating layered structures with a wide variety of starting materials and control of composition at the single atomic layer limit. To create such structures, developed a *van der Waals transfer* technique which largely eliminates interfacial contamination. We have used this technique to encapsulate 2D materials within crystalline h-BN with nearly perfect interfaces, which allows for near-intrinsic behavior in materials such as graphene, transition metal dichalcogenides semiconductors, and 2D superconductors. However, significant challenges toward functional heterostructures remain. This talk will detail our recent progress in the materials engineering for van der Waals heterostructures, including control over disorder, achieving robust electrical contacts, controlling interlayer rotation angle, and improving the quality of the constituent materials.

Bio-note

James Hone is currently Wang Fong-Jen Professor of Mechanical Engineering at Columbia University, and director of PAS^3, Columbia's Materials Science Research and Engineering Center (MRSEC). He received his BS in physics from Yale in 1990, and PhD in experimental condensed matter physics from UC Berkeley in 1998, and did postdoctoral work at the University of Pennsylvania and Caltech, where he was a Millikan Fellow. He joined the Columbia faculty in 2003. His current research interests include synthesis, characterization, manipulation, and applications graphene, and other 2D materials; nanomechanical devices; and nano-biology.