Atomically Thin Semiconducting Paper

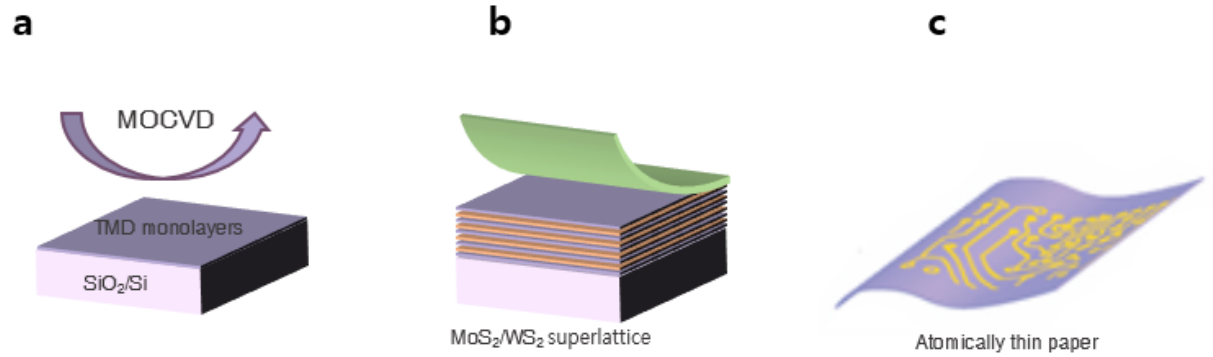
Kibum Kang, Saien Xie, Hui Gao, Kan-Heng Lee, Lujie Huang, Yimo Han, David A. Muller, Jiwoong Park

Cornell Univ., Department of Chemistry and Chemical Biology, 116 Baker Lab, Ithaca, NY 14853, USA
kk545@cornell.edu

Abstract

In this talk, I will present a novel material platform, *atomically thin semiconducting paper*, where 'paper' represents large-scale, atomically-thin, flexible, and freestanding films. To achieve these paper-like semiconducting films, the development of key techniques for uniform large scale growth and stacking of individual semiconducting monolayer films is essential. For this, transition-metal dichalcogenides (TMDs), which can form stable three-atom-thick monolayers and weak interaction with oxide substrates, provide ideal semiconducting materials. First, we recently reported a uniform growth of TMD monolayers with high electron mobility in wafer-scale using metal-organic chemical vapor deposition (MOCVD). Second, we are developing freestanding atomically thin heterostructure films by stacking multiple as-grown films, in which the thickness and composition of the resulting composite is controllable down to sub-nm length scale. We expect these atomically thin semiconducting papers to be applied to flexible, foldable and membrane optoelectronics in the near future.

Figures



a, Schematics of wafer-scale uniform growth of TMD monolayers using MOCVD **b,** schematics of artificial stacking **c**, schematics of substrate free, atomically thin, and semiconducting paper