Bending helps to control nanomaterials

22 May 2014

A new remedy has been found to tackle the difficulty of controlling layered nanomaterials. Control can be improved by simply bending the material.

The mechanism was observed by Academy Research Fellow Pekka Koskinen from the Nanoscience Center of the University of Jyväskylä together with his colleagues from the University of Massachusetts Amherst in the US. Bending decreases interaction between layers, making the material merely a stack of independent atomic layers.

The group investigated the van der Waals nanomaterials which consist of stacked and loosely bound two-dimensional atomic layers. It is experimentally difficult to control the number of layers in the stacks – and each layer may affect the electric and optical properties of the material dramatically.

It's as if the apparent color of a stack of papers would change wildly while adding or removing individual sheets, Pekka Koskinen illustrates the situation using a fictitious example.

Bending effectively detaches the layers from each other. The mechanism was observed while investigating layered molybdenum disulphide but it is expected to be valid for the van der Waals materials in general. The results were published in the esteemed journal *Physical Review Letters*.

According to Koskinen, the observation advances research in nanoelectronics and optoelectronics because it markedly simplifies the interpretation and understanding of the electronic and optical properties of layered materials. The research was computational and the found mechanism is still a prediction.

In nanoscience, experimental and theoretical research advance side by side. This time the prediction came first, and now we eagerly await for an experimental confirmation, Koskinen says.

More information: P. Koskinen, I. Fampiou, A. Ramasubramaniam, Density-Functional Tight-Binding Simulations of Curvature-Controlled Layer Decoupling and Band-Gap Tuning in Bilayer MoS2, *Physical Review Letters* 112, 186802 (2014) journals.aps.org/prl/abstract/ … ysRevLett.112.186802

Provided by Academy of Finland