

Interactions inside interlayer spaces of layered materials

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Abstract: Many layered materials such as multilayered graphene, BN, and MoS₂ have distinct physical and chemical properties related with interactions between layers. In this talk, I will present our recent theoretical works related with delicate interactions between layers themselves and with inserted liquids in interlayer spaces. First, depending on characteristics of layer interactions, it is shown that the responses of layered materials to external mechanical forces vary greatly ranging from weakly compressible, completely compressible to auxetic spacing variations [1]. Second, when water can immerse into interlayer spaces of graphene oxide, the formation of ice layers and their dislocations are shown to depend on interlayer distances critically [2], which may provide a clue to explain a recent experiment [3] on the peculiar water dynamics in graphene oxide.

[1] S. Woo and Y.-W. Son, in preparation.

[2] D. W. Bouhvalov, M. I. Katsnelson, Y.-W. Son, *Nano Lett.* 13, 3930 (2013).

[3] R. R. Nair et al, *Science* 335, 442 (2012).