An All-Inorganic Responsive Surface: Electrochemical Switching of Boron Nitride Nanomesh Corrugation

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The 3-nm nanomesh superstructure formed by a monolayer of hexagonal boron nitride (h-BN) on Rh(111) holds great promise for supramolecular ordering [1] and other nanoscale phenomena.

In this work, we have studied the potential dependent nanoscale corrugation of the nanomesh, using electrochemical STM. We find that under suitable circumstances, the corrugation of the nanomesh can be switched on and off electrochemically. The nanotexture changes are fully reversible, and are accompanied by strong changes in the dynamic wetting angle at the electrolyte|h-BN/Rh(111) interface, which was studied using a 3-electrode setup.

By analogy with observations in vacuum, and supported by deuterium desorption experiments, we propose that the macroscopic contact angle effect is caused by nanotexture switching within the 3 nm unit cell of the nanomesh, as hydrogen intercalation flattens the sp^2 hybridized boron nitride layer [2].

To our knowledge, this system represents one of the first all-inorganic responsive surfaces.

[1] Berner et al. Angew. Chem. Int. Ed. 2007, 46, 5115.
[2] Brugger et al. Angew. Chem. Int. Ed. 2010, 49, 6120.