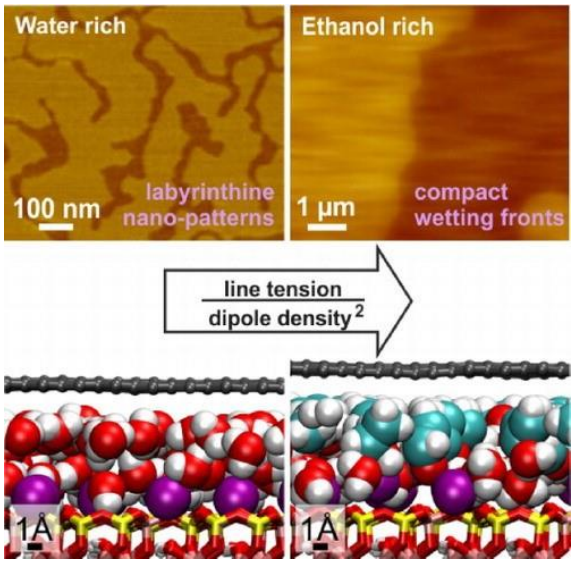
Scientific Highlight

Shaping 2D materials with small molecules



Scanning force microscopy images of graphene surfaces shaped by an intercalating molecularly thin water layer self-assembled into labyrinthine patterns (top left), and the compact wetting front of an ethanol layer (top right). The snapshots of Molecular Dynamics simulations of the interfaces filled with molecules (bottom) helped to understand the origin of the forces driving the pattern formation.

Electronic properties of 2D materials such as graphene and transition metal chalcogenides can be tailored by shaping their topography at the nanoscale. At **IRIS Adlershof**, Abdul Rauf and colleagues from the RabeLab together with Igor Sokolov investigated how to shape surfaces and interfaces of 2D materials with small molecules, intercalating at the interfaces between the 2D materials and a solid substrate. Particularly, they investigated wetting of interfaces between graphene and a hydrophilic substrate, mica, with two small molecules, water and ethanol. Wetting with water leads to labyrinthine structures exhibiting branch widths down to the 10 nm scale. This is explained by a process leading to an equilibrium between electrostatic repulsion of the polar molecules preferentially oriented at the interface, and the line tension between wetted and non-wetted areas. Increasing line tension or decreasing dipole density increases the branch width, causing eventually non-structured wetting layers. The method might be used to shape 2D materials to tailor their electronic properties.

Shaping surfaces and interfaces of 2D materials on mica with intercalating water and ethanol

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