A Chemically Saturated 2D SiO_2 Sheet - Preparation, Structure and Transfer

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Two-dimensional (2D) materials hold immense potential for creating technological solutions at the nanoscale. But in order to be utilized successfully, 2D materials need to be stable under realistic conditions, as opposed to ultrahigh vacuum and low-temperature environments. Recently, a 2D SiO_2 sheet was prepared, which has an atomically flat surface and is fully chemically saturated.[1] The tetrahedral bulding blocks form complex networks with either hexagonal or amorphous topologies.

Scanning tunneling spectroscopy and density functional theory show that the 2D silica sheet has a band gap upwards of 6.5 eV, [2,3] which makes it a promising insulator that can complement conducting and semiconducting 2D materials in heterostacks. The key aspect in making 2D silica accessible for device building is sufficient material stability. We investigate the stability of 2D silica by imaging in a liquid-environment atomic force microscope.[4] High-resolution real space data reveal the same network structure that is observed in ultrahigh vacuum, highlighting the stability of this thin film.

Furthermore, we demonstrate a polymer-based transfer of the 2D silica film, characterized with scanning tunneling microscopy, low energy electron diffraction, and Auger electron spectroscopy.[5] During a transfer from the growth substrate Ru(0001) to a new Pt(111) substrate, the nanosheet maintains its morphology without any signs of damage. Characterization using environmental scanning electron microscopy shows that the silica sheet is transferred at the millimeter scale.

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