Highly ordered atomically thin B_2O_3 crystal composed by boroxol groups

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B_2O_3 represents a singular case among polymorphic oxides, for the presence of superstructural units – planar boroxol groups, B_3O_6 [1,2] – that are absent in its crystalline polymorphs. To date, crystalline polymorphs that incorporate boroxol groups are only predicted theoretically [3], although their formation in ambient pressure is crucial to provide a framework to understand the B_2O_3 ability to vitrify. Here we present the synthesis of a bidimensional B_2O_3 polymorph constituted by boroxol groups arranged in an atomically thin honeycomb lattice. By means of surface science experimental techniques, as well as *ab initio* calculations, we characterized its regular nanoporosity over the mesoscale, its peculiar softness upon isotropic strain, its very weak electronic interaction with the substrate used for growth, Pt(111), and its large band gap in the electronic structure. This discovery adds one member to the family of bidimensional material, proves the existence of boroxol-based crystalline B_2O_3 polymorphs and enables the tracking of individual structural units that can be exploited for future studies on the crystalline-vitreous transition of bidimensional trioxides.

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Figure

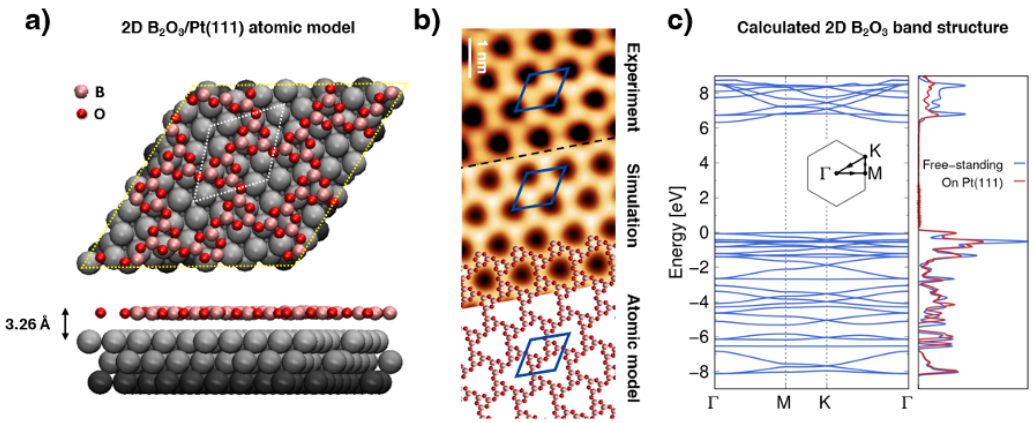

Figure 1: a) Top and side view of the optimized B_2O_3/Pt(111) model. (b) Comparison of experimental and simulated scanning tunneling microscopy images and optimized atomic model, with the 2D unit cell. (c) Calculated band structure of free-standing B_2O_3, and its density of states also on Pt(111).