Electronic Supplementary Material (ESI) for Soft Matter.

Supporting information

Increased Permeability of Oxygen Atoms through Graphene with Ripples

Guangyu He, Tao Liang, Qi Wang, Yingchun Liu and Mingsheng Xu

Graphene synthesis, exposures and transfer. Isolated graphene domains were synthesized on 25μm-thick polycrystalline oxygen-free Cu foils (Sigma-Aldrich, #349208) at about 1030 ℃ using methane as the precursor gas. Here oxygen-free Cu foil was used for the synthesis. The synthesis was performed using home-made multifunctional integrated graphene synthesis system. Transfer of graphene was accomplished with the assistance of PMMA.

After the synthesis, we cut the samples into several pieces for exposing to different environments. The isolated graphene domain-coated Cu samples were firstly vacuum-sealed in a plastic bag and then were stored in the controlled environments: a desiccator with a relative humidity of 65% and a temperature of 25 ℃. Following the exposure, the samples were cut into several pieces further and then loaded into the instrumental chambers for XPS, SHIM, and AES characterizations, which took about 20 ~ 40 min in the atmospheric laboratories.

Scanning tunneling microscopy (STM). STM experiments were performed using an *in situ* ultralow-temperature STM system (Unisoku) with a base pressure better than 2×10^{-10} mbar. The samples were heated to about 200 ℃ in ultrahigh vacuum before being transferred into the STM head. The STM measurements were carried out at 5 K in the constant-current mode with electrochemistry etched W tips. The bias voltage was applied to the sample with respect to the tip.

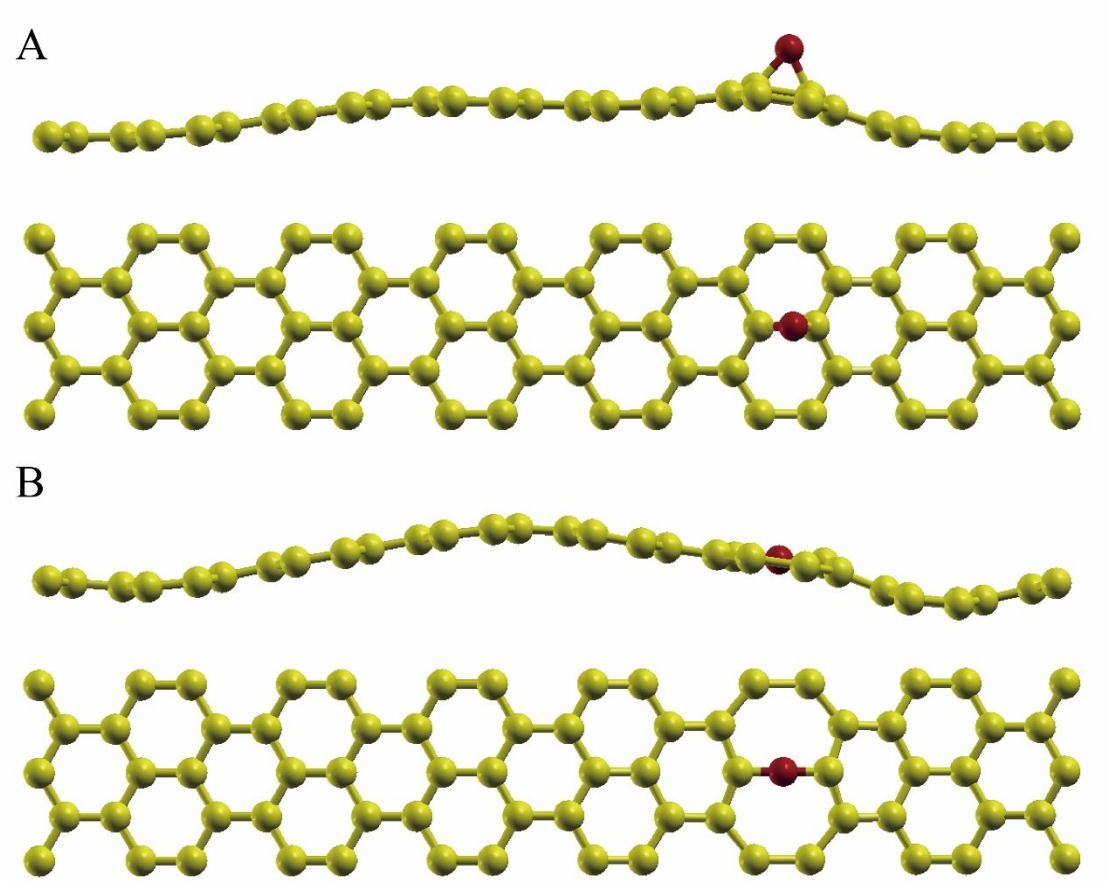

Figure S1. The front view and top view of (a) the adsorption of oxygen atom on the side of ripple 1:30 and (b) the possible intermediate configurations for oxygen atom passing through the side of ripple 1:30. The energy barrier is 5.10 eV.