A Graphene-Edge Ferroelectric Molecular Switch

We show that polar molecules (water, ammonia, and nitrogen dioxide) adsorbed solely at the exposed edges of an encapsulated graphene sheet exhibit ferroelectricity, collectively orienting and switching reproducibly between two available states in response to an external electric field. This ferroelectric molecular switching introduces drastic modifications to the graphene bulk conductivity and produces a large and ambipolar charge bistability in micrometer-size graphene devices. This system comprises an experimental realization of envisioned memory capacitive (“memcapacitive”) devices whose capacitance is a function of their charging history, here conceived via confined and correlated polar molecules at the one-dimensional edge of a two-dimensional crystal.