Can we induce a Moiré effect on Graphene with a supramolecular layer of zwitterions?

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Imposing a Moiré effect by the superposition of two-dimensional (2D) materials has recently emerged as an efficient approach to modify the band structure in van der Waals heterostructures. This Moiré effect, or superlattice, induces a periodic modulation of the electrostatic surface potential, which could lead to materials with strongly correlated electronic states.1

Until now, these experiments were done on inorganic heterostructures in which the spatial modulation and the amplitude of the electrostatic potential are determined by the lattice parameters of the inorganic 2D layers used. The versatility of these heterostructures allows for the possibility of substituting an inorganic layer with a supramolecular layer composed of dipolar organic molecules. The inherent characteristic of these molecules allows for the modulation of the surface potential amplitude, while the periodicity is determined by the lattice parameters of the supramolecular network. Our methodology involves precise control over the structural parameters of the superlattice through chemical synthesis. Zwitterionic Tetraazapentacene derivatives (ZTAP)2 were deposited onto Gr/SiC under conditions conducive to self-assembly on the surface. Scanning Tunneling Microscopy (STM) structural analysis, revealed a tilted adsorption of the molecules, followed by mapping the Local Contact Potential Difference (LCPD) using Kelvin Probe Force Microscopy (KPFM). This mapping, conducted across three spatial coordinates, demonstrated a clear and periodic shift of the LCPD at the expected position of the dipole of the ZTAP molecule. These

measurements show, for the first time, the capability to effectively modulate the surface potential on graphene through the incorporation of organic layers.

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