On-Surface Synthesis of Fused Azulenes with giant dipoles

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The realization of pure hydrocarbon magnets with net magnetic moments has been achieved by tailoring their topologies. In contrast, molecular electrets, the electric counterparts of magnets, are typically created by introducing electronegative functional groups into organic molecules, leading to local charge accumulation. However, designing molecular electrets solely by manipulating the topology of hydrogen and carbon atoms remains a challenge. Inspired by azulene's dipole moment, which originates from its nonalternant topology and π-electron delocalization, we report the on-surface synthesis of fused azulenes consisting of alternately annulated pentagons and heptagons. This is enabled by a surface-catalyzed debrominative and dehydrogenative C–C coupling of dibromoazulene, overcoming the challenge of controlling the fusion order of pentagon and heptagons. The resulting giant dipoles increase more than linearly with chain length and remain robust when fused with hexagons, offering a promising route for designing carbon-based superlattices of local charges with long-range order for molecular electret applications.

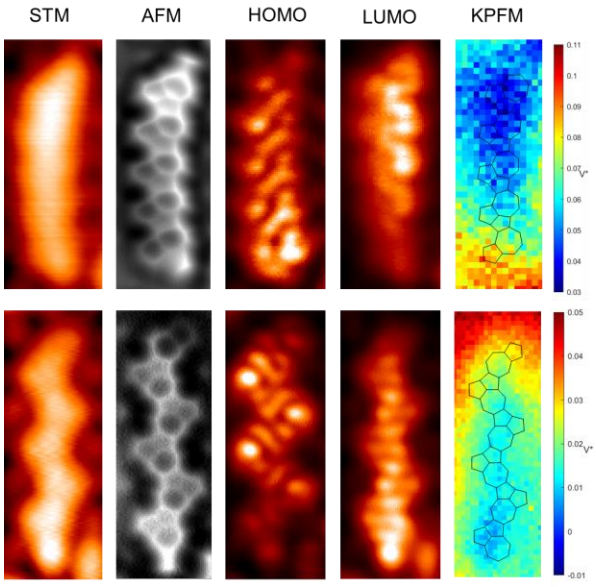

Figure 1. STM, nc-AFM, differential conductance, and KPFM images of two different fused azulene oligomers obtained by on-surface synthesis. Positive and negative charge separation has been clarified by the KPFM images.