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ABSTRACT:

Synthesis and Characterization of Monolayer Fullerene and Fulleride on Passivated Si(111) and SrTiO3 Surfaces

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Self-assembled fullerene and fulleride films on metal and semiconductor substrates hold immense potential for molecular electronics, owing to their exceptional electronic properties, including high electron affinity, superior charge carrier mobility, and complex orientational ordering. By leveraging substrate engineering, alkali-metal doping, and functionalization, researchers can precisely tune the energy levels, intermolecular forces, and molecular orientations of these films to achieve diverse functionalities. Consequently, fullerenes have emerged as a cornerstone nanomaterial for next-generation devices, such as field-effect transistors, photovoltaics, and molecular superconductors.
In this talk, we present our recent advancements in the synthesis of monolayer C60 and potassium fulleride KxC60 on metal-passivated Si(111) and SrTiO3 surfaces. Utilizing Scanning Tunneling Microscopy (STM) and Scanning Tunneling Spectroscopy (STS), we systematically characterized their molecular arrangements and local electronic states. Our findings elucidate the critical role of molecule-substrate coupling and intermolecular interactions in governing equilibrium configurations and phase transitions [1,2]. These insights provide a fundamental framework for the deterministic design of fullerene-based molecular architectures and high-performance electronic devices.

[1] Wenxuan Zhang et al., Appl. Surf. Sci. 635, 157768 (2023);
[2] Wenxuan Zhang et al., Appl. Surf. Sci. 680, 161371 (2025);