Chemical principles of N-doped nanographenes and topological superconductors

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Carbon-based functional nanomaterials, particularly graphene, have attracted a lot of attention due to their promising applications in nanoelectronics, environmental science, energy storage, quantum information science, and biosensors. Among them, nitrogenated polycyclic aromatic hydrocarbons (N-PAHs) are of paramount importance in terms of fine-tuning the band gap, optical and electrical properties, and charge transport. On-surface self-assembly and chemical reactions have become an ideal platform to attain such nanomaterials. We have thus set ourselves the task of preparing a variety of N-PAH precursors with different structural symmetries and functional groups by judicious chemical design. A range of nanostructures, including 1D N-doped graphene nanoribbons (GNRs) and highly symmetric 2D *Kagome* nanographens with desired functions have been synthesized via surface-assisted C-C coupling reactions [1–4], and directly visualized by scanning tunneling microscopy and atomic force microscopy. More remarkably, it turns out that N-PAHs can self-assemble into nanostructures via H-bonds and/or halogen bonds, whereby different charge/spin states can be manipulated at the nanoscale [5–9]. It would allow us to explore organic molecules on different superconducting substrates for the development of topological quantum bits.

This presentation will focus on chemical principles of N-doped nanomaterials and gate-tunable topological superconductivity in a 2D electron spin lattice based on our collaborative work on self-assembly and chemical reactions on various surfaces.

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