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On-Surface Synthesis of Kagome Metal-Organic Frameworks from Halogenated Aromatic Precursors

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The controlled synthesis of two-dimensional metal-organic frameworks (2D MOFs) on surfaces offers a versatile platform for the realization of designer electronic and quantum states. Surface-confined synthesis combines the structural control afforded by reticular design with the additional opportunities of enforced planarity and substrate templating. However, the resulting architectures are determined not only by the geometry of the molecular building blocks, but also by a complex interplay between precursor chemistry, metal coordination, substrate interactions, and thermally activated reaction and assembly processes.

In this talk, I will present our recent work on the formation of 2D MOFs from small halogenated aromatic precursors via surface-assisted dehalogenation. By targeting kagome lattice architectures, we explore the influence of substrate choice and reaction conditions on framework assembly and electronic structure. Using room- and low-temperature scanning probe microscopy and spectroscopy, x-ray photoelectron spectroscopy, and density functional theory, we characterize the resulting structures and their electronic properties. Our results reveal a highly substrate-dependent reaction and assembly landscape, with kagome network formation realized only under a limited set of conditions.