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Controlling Rotational Motion in Self-Assembled Porous Networks

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Reticular supramolecular architectures provide a versatile platform for integrating dynamic molecular functionality into ordered assemblies. Here, we investigate controlled molecular rotation in porous self-assembled host–guest networks on Au(111) using low-temperature scanning tunneling microscopy (STM), tip-induced manipulation, and complementary computational simulations.

We investigate molecular rotors with and without a well-defined rotational axis. Bowl-shaped molecules are anchored to Au(111) through a central atom that serves as a molecular axle, whereas other functionalized rotors lack an intrinsic rotational axis. When incorporated into porous supramolecular host–guest networks, host–guest interactions enable rotational motion while preserving long-range structural order. By comparing both rotor classes, we reveal how the nature and strength of the host–guest interactions govern their rotational characteristics.

Our results demonstrate how reticular supramolecular networks can be engineered to host dynamic molecular components, providing a general strategy for designing functional molecular architectures with tunable rotational dynamics.