METAL-ORGANIC FRAMEWORKS

Chain-link molecules form flexible networks

Catenated covalent organic frameworks could find use as additives or membranes

by ***Mark Peplow, special to C&EN***

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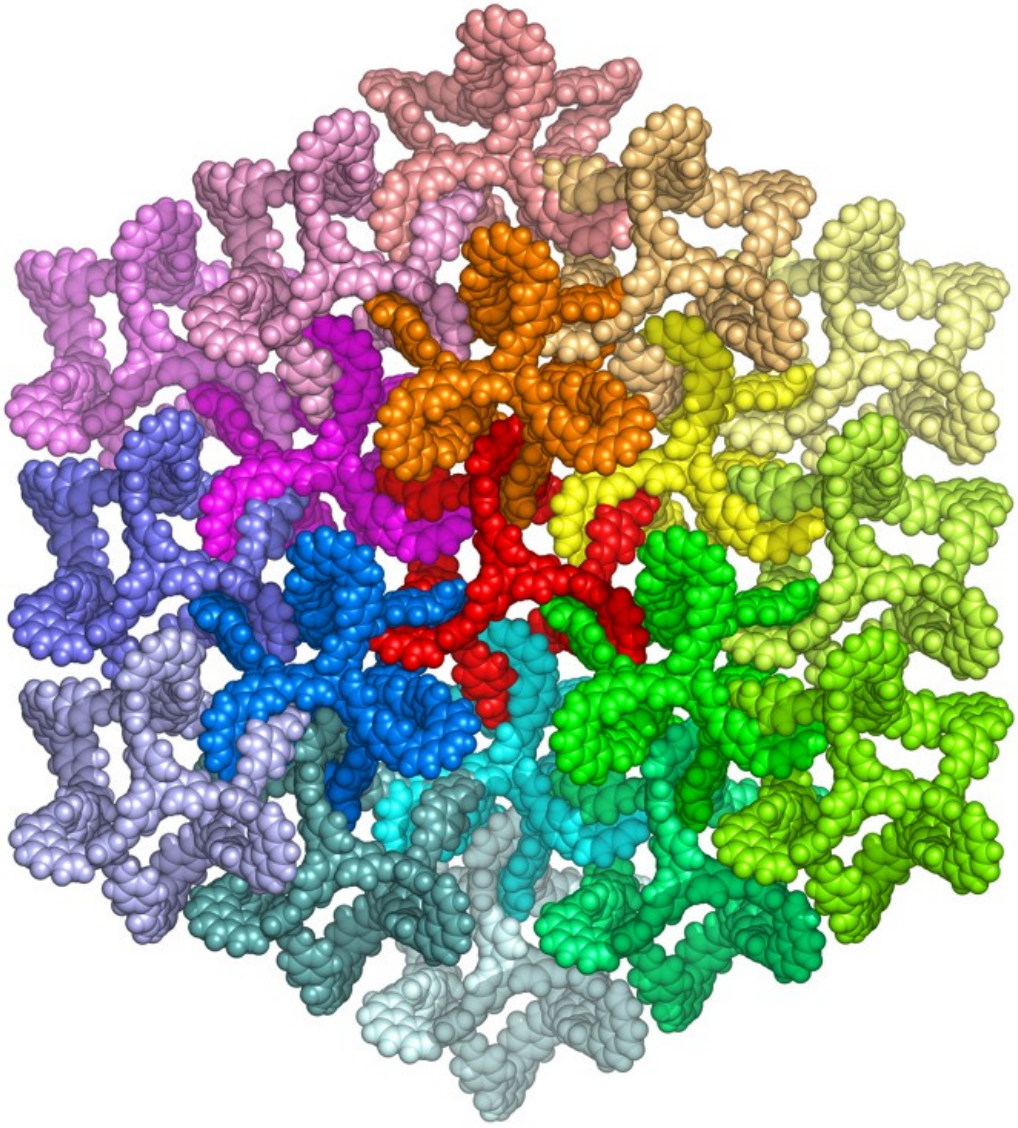

Credit: *Nat. Synth.*

The new covalent organic framework's building blocks form an interlinked network that is soft and flexible. Different colors identify individual blocks.

Covalent organic frameworks (COFs) are **porous lattices** that are finding uses in gas storage, **water filtration**, and catalysis. Now, researchers led by Omar Yaghi at the University of California, Berkeley, have built a new breed of COFs from interlocking molecules called catenanes, which hang together like chain links in a 3D network (*Nat. Synth.* 2023, DOI: **10.1038/s44160-022-00224-z**). "This physical interlocking allows materials to absorb the energy from stress," Yaghi says, adding that this feature might make such COFs useful as materials additives.

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The researchers built their catenane COFs by condensing Y-shaped triamines with aldehyde-bearing molecules coordinated around a copper(I) ion. The geometry of these precursors ensures that they form organic polyhedra with three fused rings, a shape similar to the structure of the compound adamantane. Each polyhedron is more than 3 nm wide and interlocks with six of its neighbors to form an extensive network containing millions of polyhedra.

Using aqueous potassium cyanide to wash out the copper template ions frees the polyhedra to **move around** without actually separating from one another. That makes the COFs soft and flexible, potentially attractive properties in applications as diverse as filtration membranes and soft robotics. The motion of the interlocking parts also means that the COF's pores can stretch to accommodate incoming guest molecules "almost like an enzyme adapting its active site to a substrate," Yaghi says.

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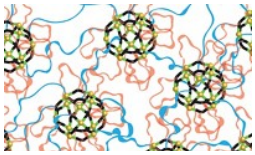

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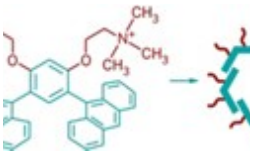

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