Controlling transport in triphenylene-based metal-organic frameworks

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Metal-organic frameworks (MOFs) show much promise as a flexible platform for applied materials thanks to their intrinsic tunability and unique porosity at the nanoscale.[1] Of particular interest are two-dimensional π-conjugated MOFs based on hexa-substituted triphenylenes[2] and benzenes,[3] where high electrical conductivities led to applications in supercapacitors,[4] thermoelectrics,[5] and electrochemical catalysts.[6] The vast majority of such MOFs, however, show poor crystallinity which prevents detailed structure-function relationship studies.

We report a new series of well-ordered and highly conductive triphenylene-based MOF materials, and show how their transport and optical properties can be controlled through fine tuning of the structure. Pressed pellets of the materials show electrical conductivity values of up to 0.05 S/cm. Variable temperature conductivity measurements reveal semiconducting behavior. Powder X-ray diffraction and density functional theory provide insight into the origin of the transport properties.

References

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