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CORRELATED DISORDERS IN LANTHANIDE MOFS

Julius Oppenheim, Jewel Ryu, Grigorii Skorupskii, Mircea Dincă, MIT
e-mail: joppenhe@mit.edu

Metallic charge transport and porosity appear almost mutually exclusive. Whereas metals demand large numbers of free carriers and must have minimal impurities and lattice vibrations to avoid charge scattering, the voids in porous materials limit the carrier concentration, provide ample space for impurities, and create more charge-scattering vibrations due to the size and flexibility of the lattice. No microporous material has been conclusively shown to behave as a metal via single crystal conductivity measurements.[1]

We have recently demonstrated that single crystals of the porous metal–organic frameworks $(LnOH)_3$(2,3,6,7,10,11-hexaoxidotriphenylene)$_2$ (where Ln = La, Nd) are metallic.[2] The materials display the highest room-temperature conductivities of all porous materials, reaching values above 1,000 S/cm. Single crystals of the compounds additionally show clear temperature-deactivated charge transport, a hallmark of a metallic material. Lastly, a structural transition consistent with charge density wave ordering, present only in metals and rare in any materials, provides additional conclusive proof of the metallic nature of the materials. Here we will discuss correlated disordering of the lanthanides and the implication on the low temperature modulated structure.

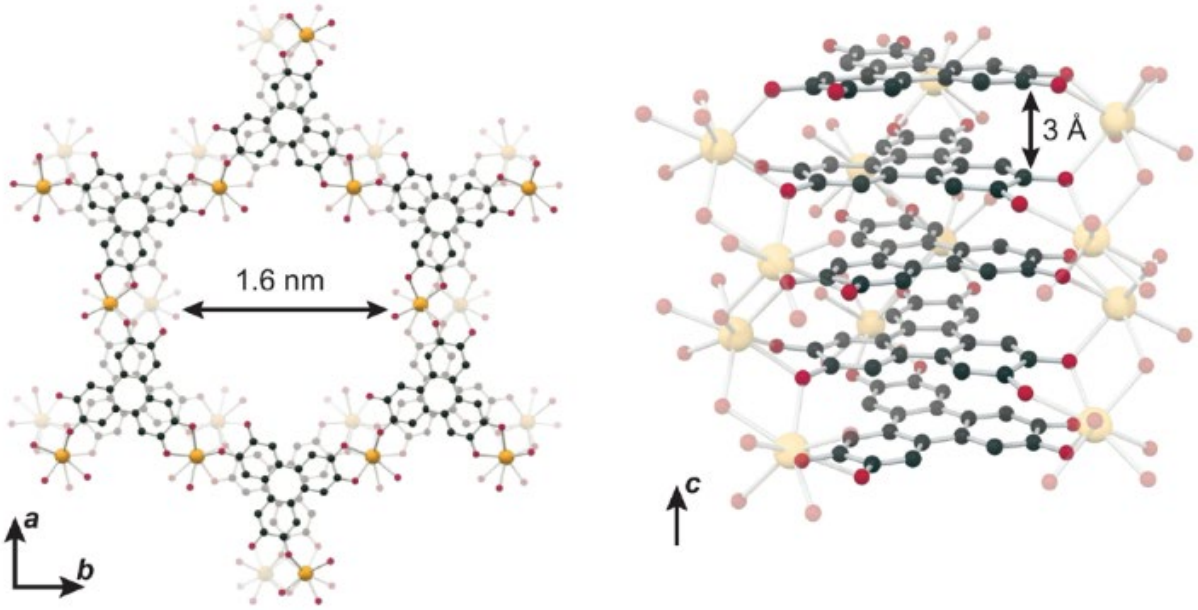

Figure 1: Crystal structure of $La_3(HOTP)_2$ (above the critical temperature)**.**

References

[1] L.S. Xie et al., *Chemical Reviews* **2020**, *120*, 8536-8580.
[2] G. Skorupskii et al., *PNAS* **2022**, *119*, e2205127119.