MECHANISM OF ORDER-DISORDER TRANSITION, AND GLASSY BEHAVIOR IN THE METAL-ORGANIC FRAMEWORK $[(CH_3)_2NH_2]Zn(HCOO)_3$

Tiglet Besara[1,2], P. Jain[1,2], N. S. Dalal[1,2], P. L. Kuhns[1], A. P. Reyes[1], H. W. Kroto[2], A. K. Cheetham[3]

[1]National High Magnetic Field Laboratory, Tallahassee, Florida 32310, USA
[2]Department of Chemistry, Florida State University, Tallahassee, Florida 32306, USA
[3]Department of Materials and Metallurgy, University of Cambridge, Cambridge CB2 3QZ, U.K.

^{1}H NMR and specific heat measurements have been used to study the order-disorder phase transition, at 156 K in the metal-organic framework compound $[(CH_3)_2NH_2]Zn(HCOO)_3$. The compound possesses a perovskite-type architecture, with the $(CH_3)_2NH_2^+$ cationic moieties essentially trapped inside the cage architecture. Above the transition, it is the orientations of these moieties that are responsible for the disorder, as each can take up three different orientations with equal probability. Below 156 K, the $(CH_3)_2NH_2^+$ is ordered within one of these sites, although the moiety still retains a considerable state of motion. As the temperature is increased from low temperatures in the NMR measurements, different relaxation pathways can be observed in the range 65 – 150 K, as a result of a "memory effect". This dynamic behavior is characteristic of a glass in which multiple states possess similar energies. This conclusion is supported by the specific heat data.