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Investigation of the Order-Disorder Transition in the Hybrid Inorganic-Organic System $[(CH_3)_2NH_2]Zn(HCOO)_3$ by means of ^{1}H NMR

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$[(CH_3)_2NH_2]Zn(HCOO)_3$, a hybrid ABX_3 perovskite, with $A=(CH_3)_2NH_2$, B=Zn and X=HCOO, undergoes a paraelectric-antiferroelectric transition around 156 K. Synchrotron studies indicate that hydrogen bonding between the H-atoms in the NH_2 group and O-atoms from the formate group is involved. The dimethylamine cation is disordered with nitrogen existing in three different positions, but not known whether statically or dynamically. We have investigated it by means of spin-lattice relaxation time, T_1, using proton NMR. We find that the cation is dynamically disordered and that the transition involves its slowing down. Evidence is seen for tunneling of the CH_3 groups, and for the compound becoming a glass, with the cation displaying several metastable equilibrium geometries (T_1 trajectories).

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