New insight into the magnetoelectric coupling effect in the MOF

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Metal-organic frameworks (MOFs) are regarded as promising candidates for multiferroics owing to their structural diversity and amenability to design. By selecting proper bridge ligands to connect neighbouring spin carries, and polarisable guest molecules to fill in the pore of the MOFs, chemists have successfully obtained MOFs with coexistence of ferroelectric and magnetic orders.1-3 Although some of them exhibit magnetoelectric coupling effect,2-3 their the magnetic order often originates from metal ions of the frameworks, while their ferroelectric order from the polar guest molecules. As a result, the magnetoelectric coupling in the MOFs is fairly weak. Herein, we report the magnetoelectric coupling effect in the MOF of [NH2(CH3)2]n[FeIIIFeII(HCOO)6]n (1). Investigation on the dielectric properties and ferroelectric polarization of single-crystal 1 along different crystal axes under external magnetic fields and analysis on the magnetic structure of 1 reveals that it is the defect in the FeII-FeIII sublattices leads to the magnetic and ferroelectric order having the same origin and plays a key contribution to the magnetoelectric coupling of 1. This result provides a new insight into the magnetoelectric coupling effect of MOFs-based multiferroics.


Keywords: Metal-organic frameworks, multiferroics, magnetoelectric coupling