

Oxyhalides—a new class of high- T_c multiferroic materials

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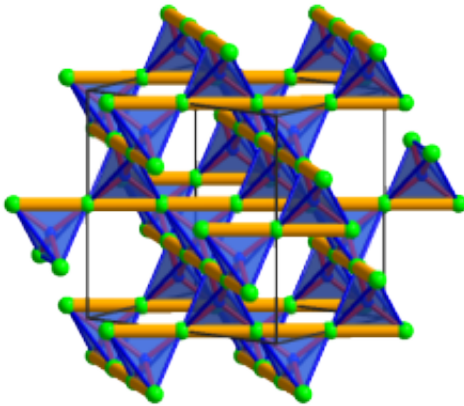


Fig a: The corresponding OCu_4 tetrahedral chains (orange)

Novel devices capable of rapidly and reliably switching magnetic states by acting on the electronic charge state are predicted to be of prime importance for tomorrow's data storage. Their realization will depend on the availability of materials that possess coupled ferromagnetic and ferroelectric order. Ferromagnetic order relies on the parallel alignment of magnetic moments created by the spin of the electrons. Ferroelectric order arises when ensembles of charges of opposite sign are displaced with respect to each other thus creating electric polarization. Coupled multiferroicity is observed when the alignment of the magnetic moments induces the charge separation and vice versa.

To be of practical usefulness the coupling should be strong and survive

to high temperatures. Given their potential impact on future electronics devices multiferroic materials have triggered an immense interest among the scientific community. There is in particular a continuous quest for new material classes with higher transition temperatures T_c .

A team from the Max Planck institute in Dresden in collaboration with ILL scientists has just reported the discovery of such a novel class of multiferroic materials. The structure of these transition metal oxyhalides can be seen in Figure a. With a critical temperature of approximately 70 K these multiferroics have to be classified as high- T_c materials. The magnetic structure (see Figure b) has been determined with neutron diffraction at the ILL on the instrument D1B.

The fact that the ferroelectric order sets in simultaneously with the magnetic order indicates that ferroelectricity is induced by the spins. This coupling and the comparably high value of the transition temperature are a progress on the way to future electronic devices. Compared to other binary copper compounds the oxyhalides allow for more chemical substitutions. Thus, by judiciously playing with the chemical composition in this class of [materials](#) the multiferroic properties might be enhanced even further.

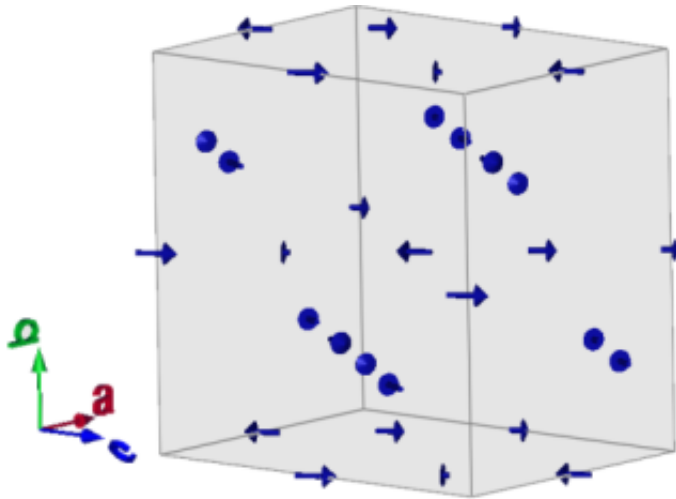


Fig b: Incommensurate magnetic structure of Cu_2OCl_2 : the spin structure

Provided by Institut Laue-Langevin

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