IMPACT OF FLUORINE BY HYDROXIDE SUBSTITUTION ON PROPERTIES OF PHOSPATE APATITE SINGLE ION MAGNETS

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Single ion magnets – paramagnetic compounds that could possess a macroscopic magnetic moment without external magnetic field – are the subject of intensive scientific research because they can be used as a tiny magnets in spintronics or high density magnetic storage devices. Usually single ion magnets represent organic complexes of d- or f-elements with volumetric ligands and a minor part of them are d- or f-element paramagnetic ions inserted in inorganic matrix. We suggested phosphate apatites as a such matrix and demonstrated that it could be used for constructing of novel single ion magnets based on such metals as cobalt or dysprosium.

Phosphate inorganic matrix providing chemical and thermal stability also allows to dilute paramagnetic centers as well as tune the magnetic properties by changing the nearest environment of magnetic ions. So barium for calcium substitution leads to substantial growth of remagnetization energy barrier U_{eff} up to 1040 cm^{-1} in Dy containing phosphates. In this work we have investigated impact of fluorine by hydroxide substitution on magnetic properties of such compounds. Hydroxides are the second surrounding of magnetic ions and also could affect on their properties.

Dy containing calcium phosphates[1] as well as cobalt containing barium,[2] strontium and calcium[3] phosphates were investigated. All the series keep their magnetic properties so magnetic centers in such compounds are quite stable. Dy containing samples show a small growth of U_{eff} with fluorine introduction. U_{eff} of cobalt containing samples stay nearly the same after fluorine insert but the observed paramagnetic centers concentration falls substantially due to competition with fluorides for positions inside the trigonal channels. This effect also causes the disappearance of single ion magnet properties in strontium and barium compounds with very high fluorine and the smallest cobalt concentrations.

References
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