SUBSTITUTION EFFECT ON THE PHYSICO-CHEMICAL PROPERTIES IN CREDNERITE CuMnO$_2$ TYPE MATERIALS

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Abstract
Recently, the ABO$_2$ delafossite-type class of materials, B being a transition element, has attracted a lot of interest. First of all in the field of transparent conducting oxides, thin films of CuAlO$_2$ show the unusual combination of high transparency and rather high p-type semi-conductivity [1]. On the other hand, in the field of the exotic magnetic and structural properties, a good example is the CuFeO$_2$ delafossite, a triangular lattice antiferromagnet which has been extensively studied over the last years for its multiferroicity [2,3].

The ABO$_2$ delafossite structure, where A=Cu and Ag, and B a transition element, belongs to the R-3m space group and is characterised by O-Cu-O dumbells linking layers of edge sharing BO$_6$ octahedra. However, in this class of materials, crednerite CuMnO$_2$ occupies a unique place due to the Jahn-Teller (JT) distortion of the Mn$^{3+}$ ($t_{2g}^3e_g$) which leads to a monoclinic structure (C2/m space group at room temperature) and to a different topology of the magnetic triangular lattice and out-of-plane stacking sequence compared to delafossite structure.

In this work, we investigated the physico-chemical properties of CuMn$_{1-x}$B$_x$O$_2$ (B=Al, Mg; x=0 - 0.08) type materials by X-Ray diffraction, SEM-EDAX, thermal analysis, UV-VIS and infrared spectroscopy. The effect of the substitution on the lattice parameter in CuMnO$_2$ is significant in order to understand the correlation between the structure and the properties in this compound. The crednerite nanoparticles were synthesized at low temperature by hydrothermal method in teflon-lined steel autoclave.

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References