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Mössbauer studies of Fe-Zn sulphur spinels

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The polycrystalline sample of Zn doped $Fe_{1-x}Zn_xCr_2S_4$(x = 0.1, 0.3) were prepared by solid state reaction. The crystal structure was determined to be the normal cubic spinel of space group *Fd*3*m* and the lattice constants(x = 0.1, 0.3) were a_0 = 9.9967(3) Å and a_0 = 9.9926(3) Å, respectively. The magnetic moment values of $Fe_{1-x}Zn_xCr_2S_4$ for the x = 0.3 were observed higher than that of the x = 0.1. The Néel temperatures were decreased to 153 K (x = 0.1), 135 K (x = 0.3) with Zn substitution concentration. This result is due to the decrease of A-B superexchange interaction by the replacement of Zn ions for A site.

1 Introduction

The fascinating ground state for Cr-based chalcogenide spinels are interested for strong-correlation between the charge, spin, and orbital degree of freedom [1]. Recently, spin-driven phonon splitting in bond-frustrated $ZnCr_2S_4$ has been reported [2]. Also, whether frustration mechanism on Cr-based spinels is originated from the geometrical structure or quenching of magnetic exchange interaction is not resolved, yet. The $FeCr_2S_4$ spinels was shown to exhibit the colossal magnetoresistance at a Curie temperature T_C = 170 K comparable with that of the manganites [3]. Furthermore, $Fe_{1-x}M_xCr_2S_4$(M = Co, Cu, Ni) substituted magnetic materials with Fe were studied and a variety of properties were reported by many workers [4–7]. Substitutions of Fe by Cu increases T_C to the values even above the room temperature, keeping at the same time the moderate magnetoresistive properties [8].
In this paper, we have synthesized the non-magnetic material Zn doped $Fe_{1-x}Zn_xCr_2S_4$(x = 0.1, 0.3), and studied on magnetic properties.