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Ferromagnetism in Fe-doped Cupric Oxide

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In the present work, as an effort to find out new DMSS with high Curie temperature and good transport properties, Fe-doped cupric oxide (CuO) thin films and powders have been prepared by a sol-gel method. It has been reported that Fe doping in CuO caused an increase in the magnetic susceptibility [1], but no ferromagnetism has been observed yet at room temperature. On the other hand, we report room-temperature ferromagnetism in the present Fe-doped CuO samples. The magnetic and electrical properties of the Fe-doped CuO samples are investigated and possible mechanism for the observed ferromagnetism is discussed.

Ferromagnetic properties were observed at room temperature for Fe-doped CuO film and powder samples. Mössbauer spectroscopy measurements on the CuO:Fe samples revealed that the octahedral Cu²⁺ sites are mostly substituted by Fe³⁺ ions as shown in Fig. 1. Existence of oxygen vacancies might play a crucial role for the room-temperature ferromagnetism in CuO:Fe. A carrier localized around oxygen vacancy can mediate a ferromagnetic coupling among neighboring Fe³⁺ spins. Additional Li doping into CuO:Fe resulted in an increase of the saturation magnetization. Unpaired 2s¹ electron in interstitial Li atom is likely to mediate a ferromagnetic coupling between neighboring spins.

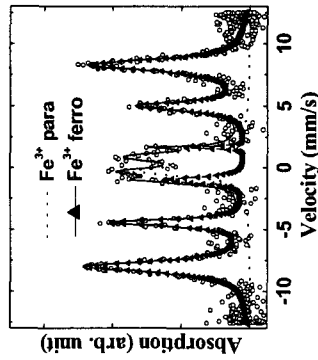


Fig. 1. Room-temperature conversion electron Mössbauer spectroscopy data for CuO:Fe film.

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SA04

Intra and Inter Layer Coupling of the V Moments in Cu(VOAsO₄)₂

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The magnetic properties of vanadium in the compound of general formula $M(\text{VOAsO}_4)_2$, where M can be a alkali metal, a alkaline-earth metal, or a organic cation are known to be sensitive to the M -site element [1]. A new polymorph of copper vanadium (IV) arsenate $\text{Cu}(\text{VOAsO}_4)_2$, in a powder form, has been successfully fabricated by employing the hydrothermal synthesis method [2]. Structural studies show that the compound crystallizes into a distorted monoclinic symmetry of space group $P2_1/c$. The structure of $\text{Cu}(\text{VOAsO}_4)_2$ may be viewed as 2D V-O networks that are connected, along the third crystallographic direction, by As-O tetrahedral and Cu atoms. Three transitions of magnetic in nature were clearly revealed in the ac magnetic susceptibility measurements. The V moments in the 2D layers order ferromagnetically below 63 K. Interlayer couplings become evident below 54 K, reflecting the appearance of domain enhancement effect. The transition at 45 K can be due to the reorientation of the V moments. Details of the thermal evolution of the magnetic behaviour will be discussed.

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