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Ferromagnetism in ^{57}Fe-doped cupric oxide

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Ferromagnetic properties were observed at room temperature for ^{57}Fe-doped cupric oxide (CuO) film and powder samples. Mössbauer spectroscopy measurements on the $Fe_{0.02}Cu_{0.98}O$ samples revealed that the octahedral Cu^{2+} sites are mostly substituted by Fe^{3+} ions. Both ferromagnetic and paramagnetic Fe^{3+} signals were detected. The $Fe_{0.02}Cu_{0.98}O$ samples were found to be ferromagnetic even above the Néel temperature of CuO. A carrier localized around oxygen vacancy can mediate a ferromagnetic coupling among neighboring Fe^{3+} ions. Additional Li doping into $Fe_{0.02}Cu_{0.98}O$ resulted in an increase of the ferromagnetic strength. Unpaired s^1 electron in interstitial Li atom is likely to mediate a ferromagnetic coupling between neighboring spins.

1 Introduction

In the present work, ^{57}Fe-doped Cupric oxide (CuO) thin film and powder samples have been prepared by a sol-gel method as an effort to find out new diluted magnetic semiconductor with high Curie temperature. 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 ^{57}Fe-doped CuO samples. The magnetic properties of the samples are investigated and possible mechanism for the observed ferromagnetism is discussed.