

Magnetic properties of Fe doped cupric oxide

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Cupric oxide (CuO) is a semiconductor promising for solar cell fabrication and an antiferromagnet ($T_N=230\text{K}$) crystallizing in a square planar coordination of copper by oxygen in the monoclinic structure. CuO films have been reported to show native p-type conductivity due to Cu vacancies in the structure.

In this work, pure CuO and CuO:Fe (2 at.%) thin film and powder samples were prepared using a sol-gel method. Undoped CuO films exhibited p-type electrical conductivity ($\sim 10^{-2} \Omega^{-1} \text{cm}^{-1}$) with carrier concentration of $\sim 10^{16} \text{cm}^{-3}$ while the Fe doped ones insulating. CuO:Fe samples maintained monoclinic structure without any second phase and exhibited ferromagnetism at room temperature by vibrating-sample magnetometry (VSM) with a saturation magnetic moment of $\sim 0.7 \mu_B$ per Fe ion (1300K) as shown in Fig. 1. Li doping into the CuO:Fe films led to an increase of the electrical conductivity. Optical properties of the films have been investigated by spectroscopic ellipsometry. Undoped CuO films were found to have a direct band gap of 1.67 eV at room temperature. The origin of the ferromagnetism has been investigated by Mössbauer spectroscopy.

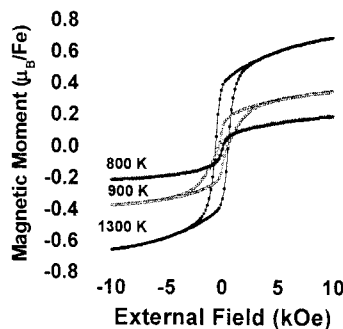


Fig. 1. Room-temperature VSM measurement result of CuO:Fe (2 at.%) powder for varying annealing temperature.