한국자기학회 2005년도 정기총회
동계학술연구발표회 및 제2차 아시안포럼
The 2nd Asian Forum on Magnetics & KMS 2005 Winter Conference

논문개요집

• 일시 : 2005. 12. 8(THU)~10(SAT)
• 장소 : 용평리조트(YongPyong Resort)
• 주최 : 한국자기학회(KMS)
• 후원 : 한국학술진흥재단(KRF)
  한국과학기술단체총연합회(KOFST)

Digests of the 2nd Asian Forum on Magnetics & KMS 2005 Winter Conference
The Korean Magnetics Society
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=230K) 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 (~10^{-2} \Omega^{-1} \text{cm}^{-1}) with carrier concentration of ~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 ~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.

![Magnetic Moment vs External Field](image)

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