

Ferromagnetic and Optical Properties of Partially Cu-Doped ZnO Films

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Z. Naturforsch. **64a**, 765 – 768 (2009); received October 7, 2008 / revised February 18, 2009

Wurtzite structure ZnO films ($3 \times 3 \text{ mm}^2$) with a partial-area Cu doping were successfully prepared using a micro-area Ar^+ -ion beam ($\sim 380 \text{ }\mu\text{m}$ in diameter) and a simultaneous Cu supply at room temperature. A Cu_2O phase was formed in the ZnO films by Cu doping. The partially Cu-doped ZnO films exhibited room-temperature ferromagnetism (RTFM) with a saturation magnetization of $1.6 \times 10^{-5} \text{ emu}$ and a coercive field of 40 Oe. Since Zn, Cu, and their compounds are not ferromagnetic, the observed RTFM is attributed to the intrinsic property of Cu-doped ZnO films. As confirmed by the low temperature photoluminescence (PL) spectra, no serious optical damage was recognized in the region without Ar^+ -ion irradiation. Thus, it was believed that the micro-area Ar^+ -ion irradiation with a simultaneous Cu supply was promising to integrate the magnetic and optical properties of ZnO-based materials.

Key words: Cu-Doped ZnO Films; Ar^+ -Ion Beam; Room-Temperature Ferromagnetism.

PACS numbers: 75.50.Pp, 79.20.Rf, 68.55.Ln, 78.55.Et