Wurtzite structure ZnO films ($3 \times 3$ mm$^2$) with a partial-area Cu doping were successfully prepared using a micro-area Ar$^+$-ion beam ($\sim 380$ µm in diameter) and a simultaneous Cu supply at room temperature. A Cu$_2$O 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 $1.6 \times 10^{-5}$ 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.  
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