

Structural and functional properties of (Cu, N) co-doped ZnO films

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Highly transparent and conductive (Cu, N):ZnO thin films with application in transparent electronics were obtained by sol-gel spin coating deposition. The effect of N doping and (Cu,N) codoping on their structure, optical and conductivity properties were analyzed by electronic microscopies, XRD, PL, optical transmission/absorption and electrical measurements. SEM, TEM and XRD data evidenced that (Cu, N) codoping determines a decrease of crystallinity, as well as of the films porosity. The dislocation density increases from $1.22 \times 10^{-3} \text{ nm}^{-2}$ in N: ZnO to $13.64 \times 10^{-3} \text{ nm}^{-2}$ in (Cu, N):ZnO films and the residual stress from 6.57 to 8.77 GPa. The near UV PL emission band shifts to red spectral region in codoped films. The absorption edge is sharp, which demonstrates the low porosity of these films. The transmission increases from 92 % in N:ZnO to 94 % in (N, Cu): ZnO. The codoped films exhibit photogenerated currents under UV light irradiation. The electronic structure of the doped and codoped systems is investigated also by abinitio calculations.