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Abstract

The improvement of electrical properties by thermal annealing of Ga-doped ZnO (GZO) films deposited by sputtering has been investigated. The resistivity of a GZO film deposited at room temperature decreases as the vacuum annealing temperature is increased up to 400 ºC. A further increase in annealing temperature increases the resistivity, resulting from a decrease in carrier density. On the other hand, the formation of a SiO_2 layer covering the surface of the GZO film eliminates this resistivity upturn, causing its decrease from 1.26×10^{-3} Ωcm before annealing to 4.1×10^{-4} Ωcm at 600 ºC. A comparison between the films annealed at different vacuum pressures have revealed that electrical resistivity is improved by preventing atomic migration between the GZO lattice and the surrounding atmosphere, i.e., oxygen absorption to or Zn desorption from the GZO lattice. The optical transmittance of a SiO_2-capped GZO film is higher than that of a bare GZO film after thermal annealing.