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Effects of Target Composition on the Optical Constants of DC Sputtered ZnO:Al Thin Films

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Al-doped ZnO thin films were deposited from ZnO:Al ceramic and Zn:Al metal alloy targets. Deposition took place in Ar and Ar + O_2 atmosphere for ZnO:Al and Zn:Al targets, respectively, using DC magnetron sputtering. Transmittance (T) measurements showed T > 80% in visible region with good NIR shielding. The band gap energy ranged from 3.34 to 3.44 eV and 3.39 to 3.46 eV for films prepared from alloy and ceramic targets, respectively. The films with lowest electrical sheet resistance of 10 Ω/□ and highest values of mobility and carrier concentration of 15.9 cm^2/Vs and 2.98 x 10^{21} cm^{-3} respectively, were obtained using alloy- target at a substrate temperature of 200 °C. However, films prepared from ceramic target at a substrate temperature of 300 °C revealed the lowest sheet resistance of 32 Ω/□, with the highest values of mobility and charge carrier concentration of 14.1 cm^2/Vs and 1.92 x 10^{20} cm^{-3} respectively. Optical spectra of the films were fitted to SCOUT software in order to determine the refractive index, *n* and extinction coefficient, *k*. Generally, the calculated *n* and *k* in the visible part of the solar spectrum for different samples, ranged from 1.59 to 2.2 and 0.00013 to 0.0194 respectively, which are in agreement with results calculated using other methods.

Key words: DC Magnetron Sputtering, Optical Constants, Transparent Conducting Oxides (TCO)