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Synthesis and Characterization of some Nanomaterials Doped with some Transition Metals

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DEDICATION

TO MY FATHER’S SOUL

TO MY MOTHER AND MY SISTER

TO MY HUSBAND AND MY SONS

Abstract

Prepared Cd_{1-x} TM_xO where TM (Transition metals) (TM= Co, Cr, Cu, Mn, Fe and Ni) and (x=0.1) in two forms nanopowder and thin film by two methods Co-precipitate for nanopowder samples and Sol-Gel for thin film samples.XRD pattern for nanopowdersamples have crystalline nature, the grain size is 47.62nm for undoped CdO and about 47.65 to57.07nm for doped CdO. The values of grain size and strain and dislocation density increase with adding transition metals. The values of glass transition temperature (T_g) of investigated samples decrease with adding transition metals; this means that the stability of the investigated samples decrease. The reflectance of the nanopowder samples increases with increasing the wavelength. The band gap energy (E_g) is 2.007eV with direct transition, the values of (E_g) increase with the addition of TM, this effect are frequently observed in n-type semiconductors. The width of tails of the localized states in the gap (E_s) decreases with the addition of TM, it represents the decrease of disorder. The refractive index (n), the dielectric constant (ε_1) , the dielectric loss (ε_2) and the dielectric relaxation time (τ) was estimated for nanopowder samples.

The agglomeration increases due to the decrease in surface area for the thin film samples. XRD pattern for thin samples have polycrystalline structure; the grain size for CdO thin film is 8.23nm; the unit cell volume is reduced with adding transition metals; the strain, the dislocation density and lattice parameter were estimated. the transmittance of thin films increases by adding due to the absorbance decreases by free carriers; the band gap energy (E_g), the refractive index (n), the dielectric constant, the dielectric losses and the optical conductivity were estimated for thin film samples. The electrical conductivity decreases with temperature and with adding transition metals. The majority carriers are electrons, which proved that CdO thin films are n-type semiconductors. The hall coefficient (R_H) and mobility were estimated. The ac conductivity for single-electron motion undergoing Overlapping Larger Polaron Tunneling (OLPT) with

polaron radius (r0=2.5). The general trend of dielectric constant (ε_1) at applied selected frequencies is decreasing for CdO thin film and is increasing temperature. CdO undoped and doped TM/Si Substrate are good diode, Mn CdO/P-Si heterojunction act as a good candidates for the production of high- efficieny photodectors; the ideality factor (n), the effective potential barrier height (φ_{B0}), the series resistance (R_s) and optoresponse (S^*_{curr}) were estimated.

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