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STRUCTURAL AND DIELECRTIC PROPERTIES OF $Zn_{1-x-y}Cd_xLi_yO$ SOLID SOLUTION

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ABSTRACT

$Zn_{1-x-y}Cd_xLi_yO$ (x=0.30 and y=0.05, 0.10, 0.15, 0.20) have been prepared by solid state reaction method. The prepared samples have been characterized by structural and dielectric measurements. X-ray diffraction (XRD) patterns show a good crystalline nature having double crystal structure and indicates the phase mixing of the constituent components. The hexagonal phase corresponding to ZnO and cubic phase to CdO is well defined and the lattice parameters are consistent with the published values (Grant in Aid report 1987). The estimated lattice parameters, bond length and crystallite size are quite consistent corresponding to the hexagonal ZnO and cubic CdO which suggests the formation of super lattice structure of the system. Crystallite size at different crystallographic planes analyzed from XRD for both ZnO and CdO lie between (15-50) nm. The variation of the dielectric constant of the samples with frequency is systematic and the dielectric constant increases with the increase of Li in the solution.

INTRODUCTION

Electronic materials are extremely important type of materials for advanced science and technology. Microelectronic devices have made possible, by new products of electronic materials such as communication satellites, advanced computers, hand-held calculators, digital watches etc. ZnO and CdO have high transparency in the visible and near infrared region of the electromagnetic spectrum and show n-type conductivity, mainly due to oxygen deficiency and lattice defects. With a band gap ranging 2.2-2.7 eV[(1)], CdO has a direct band gap of 2.3 eV[(2)] and presents the advantage of a low resistivity with respect to the high values obtained for ZnO, but this exhibits a higher transparency, having a band gap of ~3.2 eV.

Obviously, it is difficult to obtain a high transmission coefficient in the visible region and conductivity qualities simultaneously[(3)], however, a ternary compound which combines these properties in a controlled way may allow the optimization of the window layer. Since ZnO shows ultra-violet excitonic emission at room temperature, therefore it has attracted enormous interests for its potential opto-electronic applications Light Emitting Diode (LED) and Laser Diode (LD) in ultra-violet or blue spectral[(4-6)]. It is also used in solar cell and transducer. ZnO is of hexagonal wurtzite-type structure and an excitonic binding energy of ~60 meV, much larger than ~25 meV, which permits the efficient excitonic stimulated ultra-violet emission even at room temperature[(7-8)].To achieve applicable ZnO

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