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Optical and electrical characterization of Co doped Ge-Sb-S films

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Thin films of amorphous Germanium antimony sulfide (Ge₃₀Sb₁₀S₆₀) doped with cobalt (Co) have been deposited on glass substrates by thermal evaporation technique. The composition and amorphous structure of the deposited films have been characterized by X-ray diffraction and energy dispersive X-ray analysis (EDX) techniques. Optical transmission spectra measured by UV-VIS spectrophotometer showed that Co-doped Ge₃₀Sb₁₀S₆₀ have 2.0 eV optical band gap. Raman spectroscopy was used to characterize the composition and phase structure of the prepared film and shows a wide band spectrum from 300 to 410 cm⁻¹ centered at 355 cm⁻¹. The Raman shift peaks at 325 cm⁻¹ and 350 cm⁻¹ are assigned to the bond stretching mode Sb-S and Ge-S, respectively. The capacitance and conductance versus voltage measurements were performed at different temperatures. The results show a slight increase in the capacitance with temperature and it reaches a maximum value around 150°C and eventually it becomes negative. This behavior is interpreted in terms of the nucleation-growth process and the thermally activated conduction process with measured activation energy of 0.79 eV. This value of activation energy together with the measured optical gap indicates that the Fermi level is unpinned in the gap which could be attributed to gap states induced by cobalt doping.

Biography

Naser Qamhieh has received his PhD in Physics in 1996 from the University of Leuven, Belgium, where he worked with professor Guy Adriaenssens. He has joined the Department of Physics at United Arab Emirates University (UAEU) in 1999 where he is presently a full Professor. His research interest centers on experimental study of the electronic properties and density of states of amorphous semiconductors and chalcogenide glasses and among materials of interest is phase change materials used in memory devices. His research also involves fabrication and characterization thin films and nanoclusters by the existing techniques in UAEU labs. He has published over 50 research articles in refereed international journals and conferences. He was honored a Research Project Award by the Research Affairs at UAE University in 2009. Moreover, he has rich experience in teaching and developing general physics courses in UAEU. He had several contributions to pedagogical journals and conferences. For research in pedagogy, he was honored the 2009-2010 Faculty of Science Recognition Award for Excellence in Teaching and Learning.

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