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Synthesis of ZnO:Ge Thin Films via Plasma Gas Condensation

ABDULLAH CEYLAN, JANAN ALI, SADAN OZCAN, SNTG Lab. Physics Eng. Dept. Hacettepe Univ. 06800, Beytepe, Ankara, Turkey — we introduce a new method for the synthesis of Ge nanoparticle embedded ZnO thin films that are considered to be a potential candidate for photovoltaic applications. As opposed to current techniques, for the independent preparation of Ge nanoparticles, Cluster Deposition Source (CDS) utilising gas condensation of sputtered Ge atoms is used. For the synthesis of ZnO thin film host material conventional sputtering is employed. In the proposed technique independently synthesized Ge nanoparticles and ZnO thin films are combined into a composite structure on Si. XRD patterns of the samples have revealed that Ge nanoparticles preferentially settle on (113) planes on top of the (002) oriented ZnO layer. It is realized that Ge nanoparticles with sizes ranging from 16 nm to 20 nm could be embedded into a well-defined ZnO matrix. In fact, TEM studies performed on Ge nanoparticles captured on a Cu grids have manifested that Ge reach to ZnO matrix as clusters composed of particles with sizes of about 7-8 nm and then eventually grow larger due to substrate heating implemented during capping layer deposition. Optical absorption measurements have revealed that Ge nanoparticle inclusion lead to an additional absorption edge at about 2.75 eV along with 3.17 eV edge resulting from ZnO host.

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