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Microstructural Investigation of ZnO Thin Films Using Transmission Electron Microscopy (TEM) Techniques MATTHEW KELLY, Materials Science & Engineering Program, Youngstown State University, TOM ODER, Department of Physiscs & Astronomy, Youngstown State University, C. VIRGIL SOLOMON, Department of Mechanical & Industrial Enginering, Youngstown State University — ZnO thin films were synthesized by RF magnetron sputtering of high purity ZnO solid targets on c-plane sapphire substrates. Post-deposition annealing was performed at various temperatures ranging from room temperature (RT) to 900°C for 3 min. Cross-sectioned samples for TEM investigations were prepared from three different materials: non-annealed (RT), 200°C and 700°C annealed ZnO thin films. Electron transparent sample were prepared by lift-out technique in a Focused Ion Beam instrument. The investigated materials show remarkable uniformity of the ZnO thin film thickness (about 1 μm), as determined by dark-field scanning transmission electron microscopy imaging. Irrespective of the annealing time the ZnO thin films are polycrystalline. Individual grains have a columnar morphology with the long axis oriented perpendicular to the ZnO/sapphire interface. The grain size is temperature dependent, the largest grains being observed in the 700°C annealed material. Edge dislocations have been observed by atomic resolution TEM of the investigated materials. On-going work using analytical TEM techniques aims to clarify into the relationship between microstructure and photoluminescence in ZnO thin films.

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