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Effects of Sapphire Substrate Annealing Conditions on the Quality of ZnO Films¹ TOM ODER, MICHAEL MCMASTER, ANDREW SMITH, NAGARAJU VELPUKONDA, JOSHUA PETRUS, Youngstown State University — The effects of pre-deposition annealing of sapphire substrates on the properties of sputter-deposited ZnO films were investigated. The films were deposited on sapphire substrates using radio frequency magnetron sputtering from a high purity ZnO solid target. Prior to the film deposition, the sapphire substrates were annealed in different gases including argon, nitrogen, oxygen and vacuum. The deposited films were annealed in N₂ at 900 ° C for 5 min and characterized using photoluminescence spectroscopy, X-ray diffraction (XRD), Hall effect and Atomic force microscopy measurements. The optimum conditions consisted of pre-deposition annealing in oxygen. The XRD 2θ -scans from all the samples had peaks at around 34.4 ° corresponding to the diffraction from the (0 0 0 2) plane of ZnO and indicates a strong c-axis orientation perpendicular to the surface at the sapphire substrate. The near band edge luminescence spectra had peaks with narrow line widths as small as 8.59 meV and are attributed to radiative recombination of bound excitons. The Hall effect measurements indicate n-type conductivity with high electron concentrations.

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Tom Oder
Youngstown State University

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