Growth of Wurtzite ZnO on Cubic MgO by Molecular Beam Epitaxy

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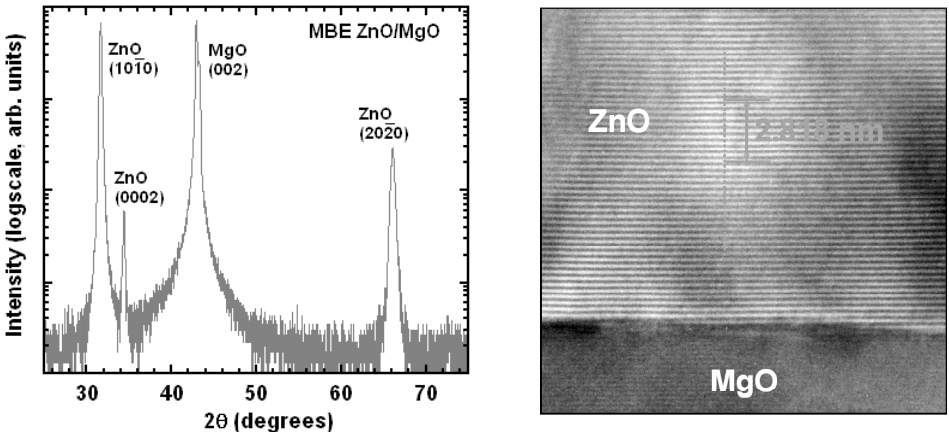

Characteristics of m-plane wurtzite ZnO on (100) MgO as described by (a) x-ray diffraction and (b) transmission electron microscopy.

ZnO and related II-VI compound semiconductor alloys are emerging as important materials for numerous optical and electronic devices. The wurtzite structure of ZnO differs from the cubic rock-salt structure of the binary compounds CdO and MgO. The ability to integrate and alloy these binary oxides allows a wide range of bandgap engineering for device applications. It is desirable to integrate other cubic oxide materials, such as ferroelectric perovskites, with semiconductors. However, most cubic oxides have an inherent chemical incompatibility with semiconductors due to problems associated with oxidation. ZnO presents an exciting possibility for the integration of a wide range of oxides with a semiconducting oxide material for novel multi-functional device applications. In this work, we have studied the growth of ZnO thin films by molecular beam epitaxy (MBE) on cubic MgO. X-ray diffraction (θ–2θ) measurements indicate a single ZnO crystalline orientation for growth on MgO (100) corresponding to a cubic ZnO (10$\bar{1}$0) phase (m-plane orientation). Transmission electron microscopy (TEM) images confirm m-plane ZnO epitaxy on MgO (100), as well as abrupt interfaces with minimal interdiffusion. This project was supported by AFOSR under contract number FA9550-04-1-0390.