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Structural and optical properties of epitaxial In₂O₃/ZnO superlattices C.Y. DANG, Q.Y. CHEN, P.V. WADEKAR, W.C. HSIEH, C.F. CHANG, Department of Physics, National Sun Yat-Sen University, H.C. HUANG, Department of Material Science and Optoelectronics, National Sun Yat-Sen University, C.M. SHIAU, Y.P. CHENG, Y.S. HONG, P.C. KUNG, C.H. LEE, S.H. HUANG, Z.Y. WU, Y.Y. LIANG, C.M. LIN, S.T. YOU, L.W. TU, Department of Physics, National Sun Yat-Sen University, N.J. HO, Department of Material Science and Optoelectronics, National Sun Yat-Sen University, C.H. LIAO, H.W. SEO, Department of Physics, R.O.C Military Academy, W.K. CHU, Texas Center of Superconductivity and Department of Physics, University of Houston — Superlattices of shallow quantum well structures with alternating layers of In₂O₃ and ZnO have been prepared by sputtering at 923K on c-sapphire substrates. Optimization of the processing parameters was attempted through varying the sputtering power, deposition temperature, and number of periods. X-ray reflectivity (XRR) assisted with analytical data fittings was used to extract the thickness, density, and roughness of the samples, while X-ray diffraction (XRD), Grazing Incidence X-ray Diffraction (GIXRD), and phi scans were adopted to verify their epitaxy. The epitaxial qualities for the samples with In₂O₃ as a starting layer are superior to those starting with ZnO based on transmission electron microscopy (TEM) atomic imaging and electron diffraction. The electronic structures according to the first-principles calculations will be discussed in association with the optical properties inferred from optical transmission and photoluminescence spectroscopy.

Q.Y. chen
Department of Physics, National Sun Yat-Sen University

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