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Photoluminescence Studies of ZnO Nanostructures Fabricated by Using Combination of Hydrothermal Method and Plasma-Assisted Molecular Beam Epitaxy Regrowth

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ZnO nanostructure was fabricated on a Si substrate using two-step growth. The seed layer was grown on the Si substrate by a sol-gel spin-coating. In the first step, ZnO nanorods were grown by a hydrothermal method at 140°C for 5 min. In the second step, a ZnO thin film was grown on the ZnO nanorods by spin-coating. After growth, these films were annealed at 800°C for 10 min. Electrical and optical properties of ZnO nanostructures have modified by plasma-assisted molecular beam epitaxy (PA-MBE) regrowth. The carrier concentration and resistivity increased by PA-MBE regrowth. In the photoluminescence, the full width at half maximum and intensity were decreased and increased, respectively, by PA-MBE regrowth.

Keywords: ZnO, Molecular beam epitaxy, Photoluminescence

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Synthesis and Temperature-Dependent Local Structural Properties of Ti₂O₃

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Ti₂O₃ is known as a typical Mott insulator with a transition temperature of near 200°C. Unlike VO₂, Ti₂O₃ does not have a structural phase transition near the metal-insulator-transition (MIT) temperature. We investigated the temperature-dependent thermal vibration change using temperature-dependent x-ray absorption fine structure (XAFS) at Ti K-edge in the temperature range of 300~600 K. Ti₂O₃ powder and films were synthesized using thermal chemical vapor deposition (CVD) at 800~900°C. X-ray diffraction measurements show a single phased Ti₂O₃ at room temperature. XAFS confirmed no structural phase transition in the temperature of 300~600 K. A small but distinguishable structural disorder change was observed near the transition temperature. We will discuss the MIT behavior with the change of structural disorder.

Keywords: Ti₂O₃, disorder, MIT, structure