

Optical and Magnetic Properties of NiO and Ni Coated ZnO Nanowires

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ZnO related materials are of great interest for photonic applications due to its wide band gap of 3.37 eV and large exciton binding energy of 60 meV. Moreover, ZnO is thermally and chemically stable in ambient air. Variety of preparation methods and obtained morphologies (such a nanorods, tetrapod nanorods, nanowires, nanoribbons, hierarchical structures, nanobridges, and nanonails) were reported for this material. In this work, a thin layer of NiO was coated on ZnO nanowires (NiO/ZnO core-shell structures) using atomic layer deposition (ALD) technique. The average diameter of the ZnO nanowires and Ni nanoparticle coated thickness are 100 nm and 4.4 nm, respectively. NiO coated samples were then treated by thermal annealing at 400°C with H₂ reduction process. As a result, only Ni nano particles remained on the surfaces of ZnO nanowires. Low temperature photoluminescence (PL) spectra show emissions at 3.35 eV and 3.345 eV due to bound exciton to neutral donor (D⁰X). The activation energy for bound exciton (D⁰X) for NiO/ZnO core-shell structures is 21.31 meV. For Ni-ZnO nanoparticles-nanowires structure, donor-acceptor pair transition increased a significantly in comparison to uncoated ZnO nanowires and NiO-ZnO core-shell structures. This is due to the reason that during thermal annealing Ni-ions diffused into ZnO nanowires which act as acceptors. This work was supported by (.....)

Acknowledgement : This work was supported by Seoul Development Institute(SDI) as a project of 'Cluster for Advanced Information Display with enhanced Human Sensibility Ergonomics' (2005)