Study of the epitaxal growth of ZnO-based thin film and the heterostructure

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ZnO, MgZnO and ZnCdO films were grown by remote plasma enhanced metalorganic chemical vapor deposition (RPE-MOCVD) and the heterostructure of ZnO-based films were investigated. ZnO is a direct transition type compound semiconductor with an energy band gap of 3.34 eV and has attracted much attention owing to their applications as blue- and UV-light emitters or UV detectors.

OH radicals not only promoted growth but also suppressed the deep-level emission in PL with O radical coexistence. PL measurements indicate high optical quality of ZnO epitaxal films.

In applications to UV detectors or UV emitters, one of the key issues is the growth of heterostructures and quantum wells. $Mg_xZn_{1-x}O$ alloy is suitable for the barrier layers of $ZnO/Mg_xZn_{1-x}O$ heterostructures due to its wider band gap. $Mg_xZn_{1-x}O$ alloy films exhibit two types of the crystal structure such as wurtzite and rock salt. Single-phase films having wurtzite structure could be prepared with x up to 0.065. A $Zn_{1-x}Cd_xO$ alloy is suitable for the active layers of $Zn_{1-x}Cd_xO/ZnO$ heterostructures due to its wavelength tuneability and a narrow band gap. The wurtzite structure of $Zn_{1-x}Cd_xO$ films was obtained by increasing the Cd content up to x=0.697.

An optical characterization of heterostructures in $Zn_{1-x}Cd_xO/ZnO$ system is highly desirable in order to realize UV-visible light emitting devices. The dependence of the PL spectra on the excitation intensity indicates the emission from the double-heterostructure is consistent with the excitonic origin the emissions. Blue-green emission (2.78eV) was demonstrated from the double-heterostructure at room temperature.