[ZnO-11]

MOCVD and Characterization of ZnO Thin Films Using an Aminoalkoxide Single Precursor

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ZnO, a wide-band gap semiconductor with an energy gap of about 3.3 eV has attracted much attention again due to its potential applications in electro-optic devicess and dilute magnetic semiconductors (DMSs). Metal organic chemical vapor deposition (MOCVD) is the most advantageous method among the preparation methods of ZnO thin films due to the excellent step coverage on the complicated features, good uniformity in thickness and composition of the film at large-area deposition and easiness for the mass production.

Choosing a suitable precursor, however, is a decisive factor to achieve the above advantages in the MOCVD of ZnO thin films. Dimethylzinc and diethylzinc are the most widely used precursors for preparing the ZnO films up to now. However, these precursors are so reactive with oxygen that the gas phase reaction may occur before the precursors reach the substrates, which would result in the incorporation of ZnO powders into the films. To prevent the pre-reaction between Zn and O sources, separate source feeding system is indispensable, consequently growth equipment becomes very complicated.

We first report on the single source MOCVD of ZnO thin films using an aminoalkoxide precursor, methylzinc(dmamp) (dmamp = 1-dimethylamino-2-methyl-2-propanolate), and the characterization of the as-grown films. β-Hydrogen elimination process is deduced to occur at the temperature range 200-400 ℃ from the analysis of the gaseous products which reacted with the heated substrates, consequently high quality ZnO films with very low carbon contaminations were obtained without any supply of oxygen source. The as-grown ZnO films were observed to be highly oriented along the c-axis by x-ray diffractometry and scanning electron microscopy. Compositional, structural, electrical and optical properties are also discussed.