

Study on the Structure and Luminescent Properties of ZnS Films

Yoichiro Nakanishi

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Luminescent properties of ZnS film electroluminescent (EL) devices are influenced considerably by the preparation conditions of the film, conditions of the substrate surface and deposition processes of the film in particular. In this study, the preparation conditions and the structure of ZnS films, and their relations with the luminescent properties were investigated. Results obtained are as follows: (1) The structure of ZnS:Mn films as a function of the substrate temperature were observed by reflection high-energy electron diffraction. The relation between the structure of the film and the EL properties were elucidated for the first time. Further, electron spin resonance measurements showed that the concentration of Mn^{2+} luminescent center in the film was influenced considerably by the substrate temperature. Films showing excellent EL were obtained on Y_2O_3 films at about $200^\circ C$. (2) ZnS films emitting blue luminescence due to a D-A pair center were successfully prepared by two-step processes, i. e. vacuum evaporation and embedding heat-treatment. (3) Epitaxial ZnS films were successfully grown on Si single crystal substrates. Further, it was found that the epitaxy of a ZnS film was remarkably improved by irradiation of low electrons to the substrate during deposition. (4) ZnO films emitting bright blue green luminescence were successfully prepared by solid-phase reaction within Cu/ZnS double films on Si suggested that these results are useful for the development of new luminescent thin film devices.