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Structural, optical and photoluminescence investigations of Eu doped ZnO spin coating films

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Eu doped ZnO thin films were successfully prepared from sol-gel solution using the spin coating technique. X-ray diffraction confirmed that all the films having a preferential c-axis orientation along the 002 plane, and their degree of orientation decreased with an increasing Eu concentration. The crystallite size was found to be a minimum for the lower Eu content (0.4 mol%) while it first increased to a maximum at 0.6 mol% of Eu ions where after it decreased again at the higher Eu concentration of 0.8 and 1 mol%. The average values of the ratio between the root mean square roughness and the average roughness for the films were found very close to the value that is predicted by the statistical theory of a Gaussian distribution asperity for the applicable surface (1.25 is the theoretical value and 1.31 is the experimental results that is estimated by the theory). The band gap was found to decrease from 3.31 eV to 3.26 eV with an increase in the Eu concentration. The indirect excitation (excited at 325 nm He-Cd laser) of the undoped film revealed that the film emitted excitonic emission as well as deep level emission of ZnO, while the Eu doped ZnO films showed small peaks related to the Eu³⁺ emission around 614 nm on top of the deep level emission. Selective excitation (at 464 nm) of the Eu doped films showed unique Eu³⁺ emission features and their intensity increased with an increasing Eu content, reaching to a maximum intensity at 0.6 mol% of Eu and then decreased.

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