Efficient energy transfer from ZnO to Nd\textsuperscript{3+} ions in Nd-doped ZnO films deposited by magnetron reactive sputtering

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Doping wide band gap semiconductors, such as ZnO, with trivalent rare earth (RE) ions is well known to enhance their optical activity. In fact, RE are well known for their optical transitions involving the 4f shell. The main purpose of this work is to study the electronic transfer between ZnO and the rare earth (RE) for photon shifting and possible applications for silicon-based solar cells. Trivalent Neodymium ions Nd\textsuperscript{3+} exhibit intense luminescence at 900 nm, just above the band gap of silicon.

The effect of deposition temperature and annealing on the photoluminescence (PL) of ZnO:Nd films is reported. The structural and optical properties of the ZnO:Nd films were characterized.

XRD structural measurements of the as-grown Nd-doped ZnO films show that high-quality strongly-oriented ZnO:Nd films can be obtained by magnetron reactive sputtering, even when the substrate temperature during deposition is as low as 15°C. Rutherford back scattering (RBS) measurements show that Nd is uniformly distributed inside the ZnO matrix. Photoluminescence measurements indicated that an efficient electronic transfer from ZnO to Nd\textsuperscript{3+} ions is achieved. In particular, excitation-dependent PL (PLE) allows deeper insight into the Nd electronic level structure.

This conversion layer will be inserted in a complete solar cell in order to test its effect on the efficiency of the cell.