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Oxidation of ZnO thin films during pulsed laser deposition process

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Abstract. Pulsed laser deposition of ZnO thin films, using KrF laser, is analysed. The films were deposited on (001) sapphire substrates at 400 °C, at two different oxygen pressures (0·3and 0·4 mbar) and two different target–substrate distances (30 and 40 mm). It is observed that in order to obtain good quality in the photoluminescence of the films, associated with oxygen stoichiometry, it is needed to maximize the time during which the plasma remains in contact with the growing film (plasma residence time), which is achieved by selecting suitable combinations of oxygen pressures and target to substrate distances. It is also discussed that for the growth parameters used, the higher probability for ZnO films growth results from the oxidation of Zn deposited on the substrate and such process takes place during the time that the plasma is in contact with the substrate. Moreover, it is observed that maximizing the plasma residence time over the growing film reduces the rate of material deposition, favouring the surface diffusion of adatoms, which favours both Zn–O reaction and grain growth.