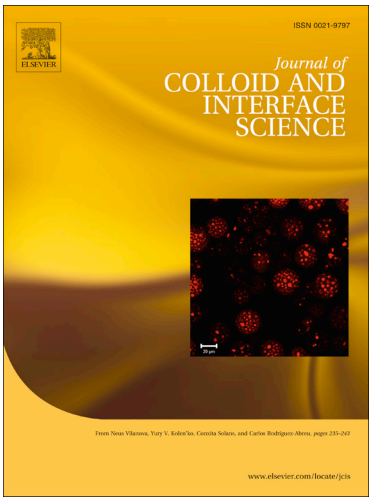

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Oxygen-defective ZnO films with various nanostructures prepared via a rapid one-step process and corresponding photocatalytic degradation applications

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The deposition of oxygen-defective ZnO films exhibiting varied nanostructures via Solution Precursor Plasma Spray (SPPS) route, a one-step, minute-scaled duration and large scale method, is reported. The *in situ* formation of oxygen vacancies in ZnO films was confirmed by UV-Visible, Raman and photoluminescence (PL) spectroscopy and the as-prepared samples exhibit a bandgap as low as 3.02 eV. Density functional theory (DFT) simulation demonstrates that the polarization of ZnO is enhanced by the created oxygen vacancies, leading to substantially improved photocatalytic activity. The comparative experiments also revealed that forming and preserving appropriate ZnO precursor clusters inside the plasma plume is requisite for obtaining propitious ZnO nanostructures, which was followed by the *in situ* transfer and growth of the clusters on the preheated substrate. The ZnO-NRs films fully degrade the aqueous Orange II dye solutions dosed at a concentration of 10 mg/L within 120 min and maintain a quasi-intact activity (95.8% retention) after five test runs, which highlight