

## An instant photo-excited electrons relaxation on the photo-degradation properties of TiO<sub>2</sub>-x films

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### Abstract

Pure and manganese (Mn) ion-doped TiO<sub>2</sub> films were grown by pulsed laser deposition under vacuum at different substrate temperatures 350 and 580 C for 50 min each. The concentration of the Mn in TiO<sub>2</sub> films was varied from 10 to 30%. The prepared films were characterized by XRD, SEM and AFM. A connection between the photocatalytic degradation performance and photo-excited electron recovery/relaxation was observed. It was found that longer photo-excited electron recovery/relaxation leads to poor photocatalytic degradation performance while shorter or even collapsing photo-excited electron improves the photocatalytic degradation performance. These photo-degradation measurements were observed with UV light. The 20% Mn doped TiO<sub>2</sub> improved the photo-degradation performance by scavenging the photo-generated electrons more than its counterparts. Moreover, the formations of many short-range than long-range orders crystal characteristics induced by the oxygen deficient environment and low substrate temperature during vacuum laser deposition resulting in formation of oxygen vacancies, this further enhanced the photocatalytic performance of the TiO<sub>2</sub>-x films. The films thicknesses reduced drastically by almost one order of magnitude after the photocatalytic activities of methylene blue.