Nb, N CO-DOPED TiO_2 NANOPARTICLES FOR BROAD SPECTRUM SOLAR LIGHT ACTIVATION PHOTOCATALYSIS

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ABSTRACT:

TiO_2 photocatalyst co-doped with Nb and N (Nb,N:TiO_2) were synthesized via a sol-gel method followed by a post thermal nitridation in ammonia atmosphere. The photocatalytic performance of Nb,N:TiO_2 was evaluated by conducting the photo-degradation of methylene blue (MB) solution under the irradiation of UV light or visible light and compared with TiO_2 and N doped TiO_2. Specific thermal condition of nitridation was found to significantly differentiate the photocatalytic activity of Nb,N:TiO_2. The result shows that proper thermal condition for N incorporation can elevate the level of charge compensation between Nb^{5+} and N^{3-}, leading to negligible formation of bulk defects and therefore strongly enhance the photocatalytic activity. However, over-intensive thermal condition of nitridation caused the generation of Ti^{3+} and oxygen vacancy in the bulk acting as charge recombination centre, resulting in the significant deterioration of photocatalytic performance. This study has emphasized the importance of understanding the complexity of the charge compensation scheme in the co-doped system, and that various defects can be introduced depending on the synthesis conditions. The photocatalytic performances in the UV and visible solar region then depend not only on the amount of cation and anion introduced, but also from the crystallographic nature of these introduced dopants in the lattice.

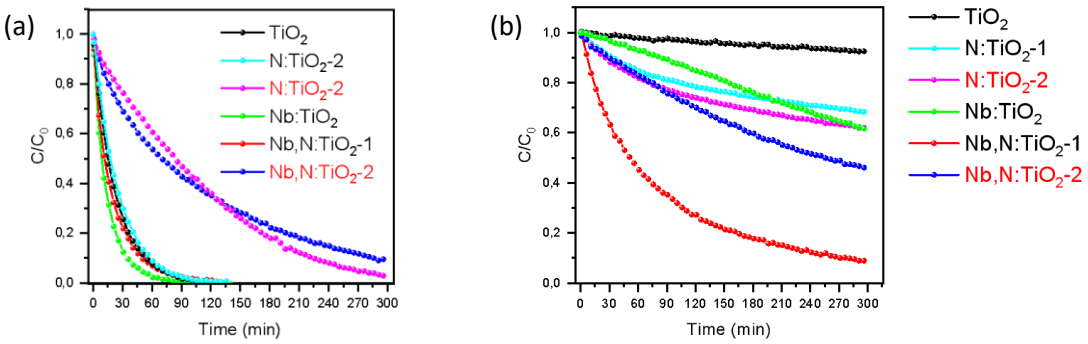

Figure 1: Degradation profile of MB under irradiation of (a) UV LED (365 nm) and (b) visible LED (450 nm)

References

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