Lanthanide (Ln^{3+})-doped Nanocomposites for Efficient Photocatalytic degradation of Organic Pollutants

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Photocatalysis is one of the efficient environmentally friendly methods to remove the organic pollutants.[1] Though there are many reports on UV and visible light induced photocatalysis, use of near infrared (NIR) light is limited. Use of NIR light for photocatalysis is interesting as they cover about 46% of the solar spectrum. We have designed a strategy to prepare an efficient NIR based photocatalyst by integrating narrow band gap semiconductor (i.e. MoS_2) with an upconverting material (i.e. $NaYF_4:Yb^{3+}/Er^{3+}$) which has the ability to convert the NIR light into visible ones.[2] Upon near infrared (NIR) excitation of the MoS_2-$NaYF_4:Yb^{3+}/Er^{3+}$ nanocomposites, the strong green and red emissions from the $NaYF_4:Yb^{3+}/Er^{3+}$ nanocrystals are absorbed by the MoS_2. [3] This resulted in enhanced NIR light triggered photocatalytic performance as verified by studying the degradation of Rhodamine B (RhB) dye under 980 nm laser excitation. The strong photocatalytic activity of MoS_2-$NaYF_4:Yb^{3+}/Er^{3+}$ composites is attributed to the layered nature of photocatalyst which leads to efficient separation of photogenerated carriers (electron–hole pairs) and excellent upconversion properties of $NaYF_4:Yb^{3+}/Er^{3+}$ NCs. The study also shows the importance of the composite formation as the physical mixture lead to only very low photocatalytic activity. This work motivated us to develop a photocatalyst which is active from UV to NIR region.[4] This is achieved using Yb^{3+}/Tm^{3+}-doped $BiPO_4/BiVO_4$ nanocomposite which shows efficient photocatalytic activity under UV−visible−near-infrared (UV−Vis−NIR) illumination.

References

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