Synergistic Effect of Gold Plasmonic Resonance and Solid Acid in Photocatalysis

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It is highly desired to remove sulfur-containing organic compounds such as thiophene/thiol from fuel oils and organic pollutants such as rhodamine B and phenol from the polluted wastewater. To mitigate these environmental problems, solar driven catalysis by semiconductors is considered as a promising route. In particular, surface plasmon resonance (SPR) may contribute greatly to improve the limited efficiency of photocatalysts.

Herein we synthesized the SPR-mediated visible-light-responsive photocatalyst, 0.5 wt.% Au/SO\textsubscript{4}\textsuperscript{2-}-TiO\textsubscript{2}, which can achieve over 99% conversion of pollutants (thiophene, thiol, rhodamine B and phenol) during photocatalytic oxidation with air as oxidant under visible light irradiation. The great enhancement of photocatalytic activity can be attributed to the synergistic effect of Au SPR and SO\textsubscript{4}\textsuperscript{2-}-TiO\textsubscript{2} acting as a Lewis acid, which are beneficial for the efficient separation and transfer of the photo-generated electrons and holes (Figure 1). Such a strategy would be important to the design and preparation of highly photocatalytic active semiconductor catalysts.

Figure 1. Schematic description of the mechanism for the photocatalytic oxidation of pollutants (e.g. thiophene) on 0.5 wt.% Au/SO\textsubscript{4}\textsuperscript{2-}-TiO\textsubscript{2} photocatalyst.

References

1- F. Lin, B. Shao, Z. Li, M. Haruta\textsuperscript{*}, J. H. Huang\textsuperscript{*}, etc. Applied Catalysis B: Environmental, 218, 480 (2017).

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