Materials

A Novel Photocatalyst to Remove NO and Reduce Air Pollution

In recent years, the growing emission of NOx has led to major environmental problems such as photochemical smog, acid rain and haze. NO_x mainly exists in the form of NO under high temperature conditions, which accounts for about 95% of the initial released NO_x. Generally, chemical removal of NO is achieved through reduction or oxidation by catalysis. Oxidation is less desirable as it produces NO_2 and NO_3−.

Conventional approaches such as selective catalytic reduction, three-way catalysis and wet scrubbing are not economically feasible to treat air pollutants in urban environments. Therefore, it is critical to develop a strategy to remove NO by selective reduction at very low concentrations.

A group led by WANG Chuanyi at the Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences has developed a plasmonic Ag-TiO_{2-x} nanocomposite for the photocatalytic removal of NO with high selectivity under visible light. Researchers used the commercial P25 (a mixture of anatase and rutile TiO_2) as the raw materials to synthesize the visible-light-driven plasmonic photocatalyst Ag-TiO_{2-x} composite. The Ag loading amount was optimized at 2.5% based on former evaluation of the loading amount effects.

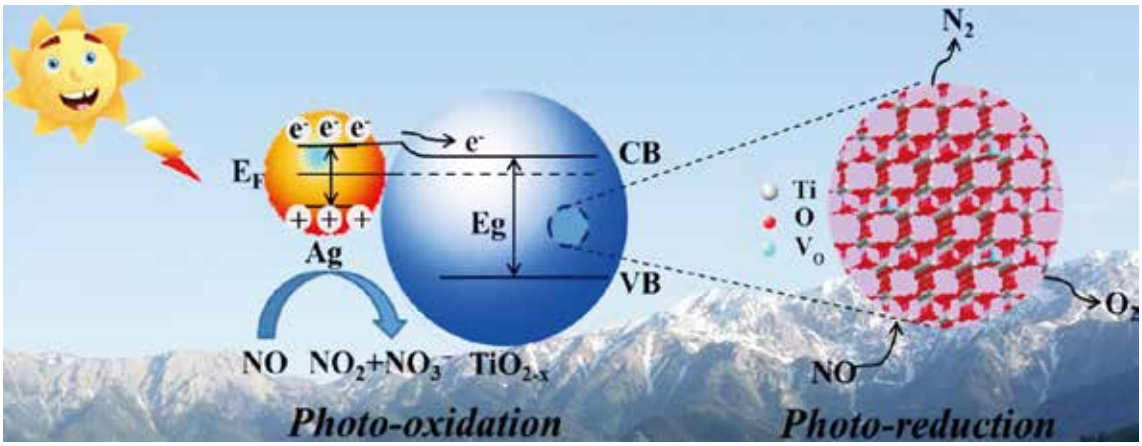
Results of electron paramagnanetic resonance and Raman spectra proved that the post-annealing treatment of TiO_2 leads to oxygen loss and the formation of oxygen vacancies (V_O). High resolution transmission electron microscopy results indicated that close Schottky contact was formed at Ag-TiO_{2-x} interface after the post-annealing treatment, which favored the photogenerated electrons transfer and restrained the carrier's recombination.

Besides, researchers found the photoactivity of Ag-TiO_{2-x} composite was approximately twice higher than that of the commercial P25, and Ag-TiO_{2-x} could significantly inhibit the production of NO_2.

Researchers deduced that the photo-oxidation of NO and selective photo-reduction of NO to N_2 occured simultaneously during the process of NO removal by Ag-TiO_{2-x}. The oxidation of NO was due to the synergic effect between superoxide radicals and photogenerated holes, while the selective photo-reduction was resulted from introduced V_O in TiO_{2-x}.

Their work provided new insights into the different effects of photo-generated reactive species on NO photo-oxidation and V_O on NO photo-reduction, and can open a promising avenue to developing novel materials with effective light harvesting property and reactivity for photocatalytic removal of NO.

The study was published in *Applied Catalysis B: Environmental*.



A plausible mechanism for visible light induced photocatalytic NO removal on Ag-TiO_{2-x}.