How to design visible light driven photocatalysts: Phase-selectively disordered Anatase or Rutile in mixed P25 TiO_2

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The phase-mixed anatase and rutile crystalline P25 TiO_2 is one of the the most widely applied meatl oxides as photo catalyst under UV light. Until now, however, there is almost no report about how to design and modulate the visible light driven P25 TiO_2 photoctalysts. To enhance a visible light absorption as well as an efficient charge separation, a conceptually new approach should be considered.

Here, we demonstrate the crystalline phase-selectively disorder engineered P-25 TiO_2 nanoparticles using simple room-temperature solution processing, which maintains the unique three-phase interfaces composed of ordered white-anatase and disordered black-rutile [1] or ordered white-rutile and disordered black-anatase [2] (called *Hyoyoung Lee's blue TiO_2*) with open structures for easy electrolyte access. The order/disorder/water junction efficiently separates the redox sites for oxidation and reduction processes, leading an excellent photocatalytic activity under solar and visible light. In addition, the heterostructured hybrid metal oxide photocatalysts have been used for various applications such as CO_2 reduction reaction (CO_2RR). We selected WO_3 and blue TiO_2 as the components of a Z-scheme metal oxide hybrid photocatalyst system. The resulting blue TiO_2/WO_3 hybrid has a Z-scheme charge transfer system that provides good electron-hole separation by forming contact interfaces and is stable under an oxygen atmosphere. To achieve both of high selectivity and yield for producing CO only in the solar light-driven photocatalytic CO_2RR, we loaded Ag NPs, which provided 100% selective CO [3].

References

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