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Photocatalytic performance of the polyhedral SrTiO₃ and composite materials with multi-band response

Abstract:

The cubic SrTiO₃ is a well-known perovskite semi-conductor as the excellent dielectric and piezoelectric properties. However, due to the band gap width of 3.2 eV, it has only shown excellent photocatalytic performance under the ultraviolet light band. Based on the decade of research, using the methods of hydrothermal, molten salt, ions doping, and surface modification, the research team led by the author had synthesized various SrTiO₃ photocatalytic materials including the polyhedral SrTiO₃, hollow-cage SrTiO₃, the related composite materials, and a unique composite of polyhedral SrTiO₃ and quantum dots. Importantly, the innovative SrTiO₃ with 26-facet and hollow cage morphology were first synthesized, which had never been reported before. Moreover, in aspects of crystal structure, thermal stability and chemical stability, the polyhedral SrTiO₃ crystals showed distinguishing and excellent performances, as well as the carrier transport characteristics and photoelectric conversion capabilities verified by multiple experiments. Simultaneously, the author proposed a new excited state model of photo-induced carrier by studying the enhancement mechanism of the light absorption ability and the separation efficiency of photo-induced electron-hole pairs in polyhedral SrTiO₃. And through regulation of crystal structure and the exposed crystal facets distribution effectively, polyhedral SrTiO₃ had achieved multi-band light response. In summary, as new photocatalytic materials, we are convinced that the polyhedral SrTiO₃ and the related composite materials have great potentials for future applications in photocatalysis and green energy fields.

Biography

Dr. Dongping Duan is a distinguished researcher affiliated with the Institute of Process Engineering at the Chinese Academy of Sciences, China. With expertise in materials science and engineering, Dr. Duan has made significant contributions to the field of semiconductor photocatalysis, particularly focusing on the synthesis and characterization of SrTiO₃-based materials. Throughout his career spanning over a decade, Dr. Duan has led a pioneering research team in exploring various synthesis methods, including hydrothermal, molten salt, ion doping, and surface modification techniques, to develop advanced SrTiO₃ photocatalytic materials. Notably, his team's groundbreaking work includes the synthesis of novel morphologies such as polyhedral SrTiO₃ and hollow-cage SrTiO₃, along with innovative composite materials incorporating quantum dots.