Short Communication

Preparation of Rod-shaped Bi₅O₇I as Bifunctional Material for Supercapacitors and Photocatalysts

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The preparation of new functional materials is one of the most effective, yet difficult methods for solving both energy shortage and environmental pollution problems. Bismuth iodide series oxides have been increasingly studied and favored in the field of supercapacitors and photocatalysts due to their unique morphological characteristics and excellent electrochemical performance. In this study, 3D rod-shaped Bi₅O₇I rich in bismuth and oxygen was synthesized from BiOI by adjusting the pH. A variety of advanced characterization techniques were used to systematically study the chemical composition, structural characteristics, surface properties, morphological characteristics and electrochemical and photocatalytic performance. Results showed that flaky BiOI and 3D rod-shaped Bi₅O₇I were successfully prepared with good crystal structure and high phase purity. The electrochemical impedance spectroscopy (EIS) of rod-shaped Bi₅O₇I were lower than BiOI because Bi³⁺ could easily migrate in Bi₅O₇I to reach a higher specific capacitance value (363 F/g). The high capacitance retention rate (72.9%) of rod-shaped Bi₅O₇I electrode indicated its high-rate capability. In addition, because of the large forbidden band width and suitable conduction and valence band positions of Bi₅O₇I, an increased number of holes could be generated under visible light radiation while the recombination of electrons and holes could be effectively hindered, thereby improving the photocatalytic performance. Carbamazepine (CBZ) anticonvulsant wastewater was degraded efficiently with a degradation rate of 97.1%, and K (degradation rate constant) of 0.021/min. In addition, recycling performance was also satisfactory, and the degradation efficiency of CBZ still remained above 85% after 6 cycles. This study provides a new way to develop new efficient supercapacitor electrodes for degrading organic pollutants in the environment.

Keywords: Supercapacitor; Photocatalysis; Bi₅O₇I; BiOI; Carbamazepine; Degradation

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