S3.1.3 TiO2/ZnO/Bi2O3 Composite Nanofibers for Air Purification

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Semiconductor heterojunction structures can effectively enhance the separation efficiency of photogenerated electron/hole pairs and the subsequent photocatalytic performance. Novel TiO2/ZnO and TiO2/ZnO/Bi2O3 composite nanofibers, synthesized by a simple sol-gel assisted electrospinning method, exhibited much higher photocatalytic activity for the oxidation of nitrogen monoxide (NO) under simulated solar irradiation than commercial TiO2 nanoparticles. These composite nanofibers have increased absorption in both UV and visible range when compared with TiO2 nanoparticles. The enhanced photocatalytic activity of TiO2/ZnO and TiO2/ZnO/Bi2O3 is attributed to the difference in the energy band positions of anatase, rutile, zincite and bismuth oxide, resulting in both lower band-gap energy and reduced recombination rate of photogenerated electron/hole pairs. Moreover, the photocatalytic performances are more stable for TZ and TZB nanofibers than that of TiO2 nanoparticles, which are easily deactivated. Faster kinetics (resulting in higher reactor throughput) and higher conversion efficiency of NO and o-xylene (simulating VOC) may be realized by optimizing the bismuth concentration in the composite nanofibers.