DIRECT SONOCHEMICAL PREPARATION OF HIGHLY PHOTOACTIVE MESOPOROUS TITANIUM DIOXIDE WITH A BICRYSTALLINE FRAMEWORK

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Mesoporous TiO_2 with a bicrystalline (anatase and brookite) framework was synthesized directly without thermal treatment under high intensity ultrasound irradiation in the absence (SM-1) and presence (SM-2) of triblock copolymer (Fig. 1). In the absence of triblock copolymer, the mesoporous TiO_2 was formed by the agglomeration of monodispersed TiO_2 sol particles (Fig. 2). In the presence of a triblock copolymer as a structure-directing agent, the crystalline size, pore size (Fig. 3), and brookite content were all increased. XRD, TEM, nitrogen adsorption, TGA/DTA and FTIR were used for the characterization of mesoporous TiO_2. Ultrasound irradiation and the use of triblock copolymer seem to be beneficial to the formation of brookite phase. Both as-prepared mesoporous TiO_2 samples show better activities than commercial photocatalyst Degussa P25 in degradation of acetone in air. The activities of mesoporous TiO_2 after calcination increase because of better crystallization. The best mesoporous TiO_2 is 80% more active than P25. The high activities of the mesoporous TiO_2 with a bicrystalline framework can be attributed to the combined effect of the presence of brookite, high surface area and interconnection of mesopores.

References:

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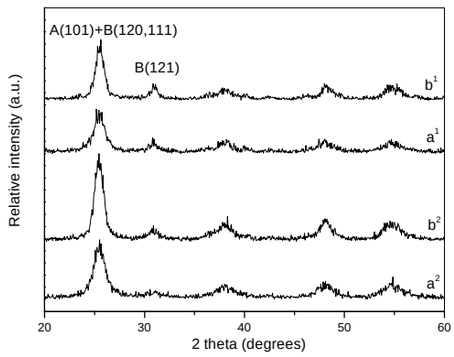

Fig. 1. XRD patterns of SM-1 and SM-2, A denotes anatase, B denotes brookite, a^1 denotes the as-prepared SM-1, b^1 denotes the calcined SM-1, a^2 denotes the as-prepared SM-2, b^2 denotes the calcined SM-2.

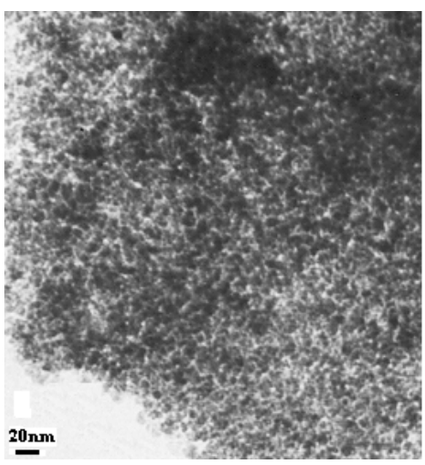

Fig. 2. TEM image of the as-prepared SM-1.

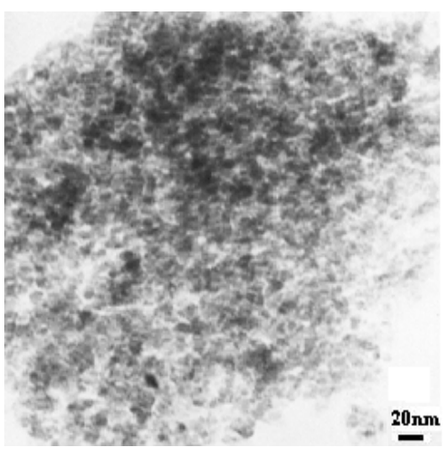

Fig. 3. TEM image of the as-prepared SM-2.