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Formation of Titania Particles via Incorporation of Titanium (IV) Oxyacetylacetonate into Mesoporous Silica

Amorphous titania is useful substance in applications as UV absorber. Controlling morphology of the particle is limited because of its instability. It has been reported that the morphology of anatase particles was controlled using nanopores in a mesoporous silica.[1)] However, there is no report on the morphology control of amorphous titania. We report that size of the particles is reflected from pore diameters of SBA-15 using titanium (IV) oxyacetylacetonate ($TiO(acac)_2$). We also study that surface density of silanol groups on SBA-15 affects a structure of titania particle.

SBA-15s with pore diameters of 8 and 18 nm were prepared according to a previously reported method.[2)] After impregnation into a methanol solution of $TiO(acac)_2$ at a Ti/Si ratio of 1/5, the products were calcined at 1000°C. Surface density of the silanol groups was increased by reacting aq. HCl at 100° C for 24 h.

Based on XRD analysis, anatase crystals were formed with the size of approximately 20 nm, when the original SBA-15s were used. On the other hand, no diffraction due to anatase was observed, when using acid-treated SBA-15 (8 nm). The particles observed in TEM images were same size as the pore diameter without lattice fringe of TiO_2. Pore diameter and surface density of silanol groups on SBA-15 were dominant factors in determining the crystallinity and the particle size of final titania; particle growth and crystallization to anatase were restricted on the silanol groups with a higher density in 8 nm of the pore diameter.

1) K. Vibulyaseak, et al., *Langmuir*, **33**, 13598 (2018); 2) M. Sohmiya, et al., *Nanoscale Adv.*, **1**, 1726 (2019).