Atomic Layer Deposition of TiO_2 on Porous Alumina Particles in Fluidized Bed Reactor

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Owing to inherent nature of self-limiting growth in atomic layer deposition (ALD), coating by ALD on porous particles has been exploited for catalysis, solar cells, fuel cells and so on. Generally exposure times of precursors should be much longer on porous particles than on flat substrates due to internal and/or external diffusion-limited growth behavior. In order to achieve the self-limiting growth condition in a shorter exposure time, the particles should be fluidized in the ALD reactor for facilitating the external diffusion of precursors between particles. In this work we performed ALD of TiO_2 on porous alumina particles in fluidized bed reactor. $TiCl_4$ and H_2O were used as Ti and O precursors, respectively. Because the alumina particles have a particle size of 200 ~ 300 μm and an average pore size of 89 nm, the ALD on the alumina particles were internal diffusion - limited. By using a shrinking core model previously proposed for the internal diffusion - limited ALD (Lee, et al., *J. Phys. Chem. C* 2010, *114*, 18601), we could explain the minimum exposure time of $TiCl_4$ on the porous particles.