200a Magnetically Recoverable Tio_2 Photocatalyst Particles by Means of Atomic Layer Deposition

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Titania (TiO_2) is a well-established general purpose UV-photocatalyst for decomposing biological and organic contaminants. Ultrafine TiO_2 is a desirable candidate for a catalytically active additive to polluted water or air streams, although its drawbacks include non-recoverability. Atomic Layer Deposition (ALD) is a process by which conformal, pinhole-free oxide barrier coatings can be applied to a variety of substrate types (e.g. metals, metal oxides, and polymers) and geometries. Particle ALD offers the flexibility to augment bulk particle properties with desired surface properties by depositing controllable-thickness, functional oxide layers. ALD is employed here to deposit nano-thick films of TiO_2 onto iron nanoparticles, thus creating recoverable, high surface area, magnetically separable photocatalyst particles. The effectiveness of a surface catalyst is directly tied to active substrate surface area and surface quality. It is known that the crystalline phase (amorphous, rutile and anatase) of TiO_2 ALD films is temperature dependent; a phase-based activity dependence will also be presented and optimized for comparison to the photocatalytic activity of commercially available Degussa P25 TiO_2 nanoparticles. Environmental restoration efforts can be greatly enhanced by the availability of a cost-effective, renewable photocatalyst such as an ultrafine TiO_2 coated ferromagnetic nanoparticle.