Aerosol processing of hierarchically organized TiO_2 based nano-particles

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The low-temperature (T=150°C) aerosol route, representing a feasible bottom-up technique for nano materials processing in disperse system, was applied for the synthesis of spherical, non-agglomerated, hierarchically organized titanium dioxide (TiO_2) nano-particles. The diverse levels of structural, morphological and functional complexity were explored simply by means of appropriate selection of different colloidal precursor solutions of either nearly spherical nano-particles[1] (a), surface modified nano-particles with dopamine (b) or nano-tubes (c). The detailed structural and morphological investigations were done by X-ray powder diffraction (XRPD), laser particle size (LPS) analysis, scanning and field emission electron microscopy (SEM/FESEM) and transmission electron microscopy (TEM). Spherical, submicronic, soft and grained TiO_2 particles with the mean size from ~350 to ~450nm and with clustered inner structure, composed of primary nanocrystals (<10nm), were obtained. The optical properties and surface structure were analyzed by UV-Vis diffusive reflectance (UV-Vis DRS) and Fourier transform infrared (FTIR) spectroscopy. The obtained results offer a general route for the synthesis of self-assemblies with tunable morphology and optical properties. A significant decrease of the effective band gap values (1.7 to 1.9eV) for the processed TiO_2 nanoparticles, compared to the band gap of bulk material (3.2eV), was achieved. Such hierarchical nano-structured powders, are expected to have potential application not only in the field of photovoltaic technologies[3] but also in various aspects of photo catalysis.[4]

References:

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