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Aerosol-assisted low-temperature processing of colloidal TiO_2 nanoparticles: two different manners for improving the optical properties

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In order to preserve unique properties of TiO_2 nanoparticles towards their surface modification, two different approaches of low temperature aerosol-assisted processing were performed. Both were based on colloid precursor atomization and subsequent spray drying at T=150 ^oC in a hot wall reactor. In the first case, pure TiO_2 colloid precursor solution was atomized and produced submicronic particles are subsequently modified, while in the second one atomization of already modified colloid precursor solution were done. In both cases the TiO_2 surface modification was achieved with 30 % of dopamine. Powders crystallinity and phase composition were studied by X-ray powder difraction (XRPD), while detailed powders morphological characterization was followed using scanning and transmission electron microscopy (SEM and TEM). Optical properties of the surface modified TiO_2 particles were investigated using reflection spectroscopy while the binding structure between dopamine and the surface titanium atoms was investigated by FTIR spectroscopy.

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Goethite nanoparticles synthesized with addition of various surface active substances

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To receive monosized goethite (α-FeOOH) nanoparticles in the process of chemical precipitation from iron salt and alkali various surface active substances (SAS) were added in water: $C_{12}H_{25}NaO_4S$ (SDS), $C_{12}H_{38}ClN$ (CPC) and EDTA $C_{10}H_{14}O_8N_2Na_2$ (complexon). Investigations by means of TEM and Mossbauer spectroscopy show, that addition of CPC increases the amount of small particles with sizes of 2-5 nm in comparison to goethite nanoparticles, obtained without SAS. However in case of SDS and EDTA the growth of well-crystallized goethite particles with sizes of about 100*20nm takes place.

Thermomagnetic analysis revealed unusual behaviour: in the temperature region of 200-500^oC peaks of magnetization are occurred. These peaks can be explained by transformations of various organic Fe^{3+}- complexes, formed on the nanoparticles surface, under SAS influence to magnetic phases.