Structure Peculiarities of Polydisperse TiO_2 Particles with Metal-Modified Surface

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Nowadays polydisperse titanium dioxide (TiO_2) is one of the most popular investigated object among metal oxides due to its wide applications.

TiO_2 materials of a high chemical purity, as-prepared and modified by metal cations (Fe^{3+}, Co^{2+}, Cu^{2+}), have been investigated by the X-ray diffraction, X-ray fluorescence and AFM methods. All TiO_2 powders have a fine-dispersated anatase structure and consist of grown together nanocrystallites of ~ 8 – 17 nm. TiO_2 particles, usually ranging from 100 to 600 nm, show the ability to form large agglomerates, up to 2 μm in size. Contrary to pure anatase, metal-modified TiO_2 particles possess a positive charge on their surface and can be lifted away by the AFM tip from the substrate surface during the scanning. The strength of interactions between the AFM silicon tip and TiO_2 powders is different for each sample. In particular, the AFM tip removes Fe/A300 particles up to 250 nm in diameter, Co/A300 – 180 nm, Cu/A300 – 120 nm. The possible interaction mechanisms between different TiO_2 particles and the silicon tip are discussed. The electrostatic force has been found to play an essential role in the sample – tip interaction processes, and its value depends on the type of metal cation used.

Keywords: structural characterization, AFM, inorganic oxides