The Synthesis Conditions Influence on The Phase Stability of Nanodispersed Titanium Dioxide

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For today, titanium dioxide TiO_2 with different polymorphous modifications (anatase, rutile, brookite) is the most promising active material for photocatalytic and photoelectrochemical devices. Its phase composition, morphological characteristics and temperature stability are the parameters determining the efficiency and practical application of such systems.

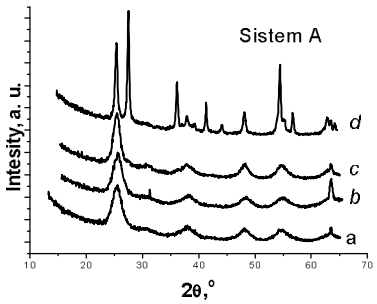

Fig. 1.XRD patterns of system A (a) before and after calcinations at (b) 200°C, (c) 400°C, (d) 600°C

TiO_2 nanoparticles were obtained by hydrolysis of titanium tetrabytuloxide in a mixture of anhydrous ethanol, nitric acid, distilled water and PEG300 [1]. Resulted precipitate was received by centrifugation (system B) and then hydrothermally treated at the temperature of 160°C for 5 hours (system A). All samples were additionally annealed on air at the temperatures of 200, 400 and 600°C for 1 hour. X-ray diffraction confirmed that synthesized TiO_2 in both cases was the mix of anatase and brookite. System A after annealing at 200°C (Fig. 1) has an anatase relative content increased from 39 to 64 %. The annealing at higher temperature of 400°C caused the appearance of rutile phase (8 %) and the decrease of anatase relative content (55 %). The annealing at 600°C led to the phase transition of anatase/brookite to rutile, the relative content of which exceeds 40 %. In the case of system B (Fig. 2), at the temperature of 200°C the material was a mix of anatase and brookite phases with increased relative content of anatase from 48 to 67 %. At 400°C the phase composition contains 15-17 % of rutile. And after annealing at 600°C rutile became a dominant phase in the sample of the system B, while anatase content does not exceed 2 %. Thus, the method of hydrothermal treatment combined with deposition provides a nanosized titanium dioxide with temperature stable anatase phase while maintaining the average particle size of the material in the vicinity of 4.5 nm.

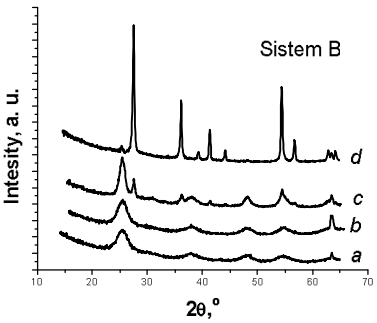

Fig. 2.XRD patterns of system B (a) before and after calcinations at (b) 200°C, (c) 400°C, (d) 600°C

1. K. Yu, J. Zhao, Y. Guo, X. Ding, Y. Liu, Z. Wang, *MATER LETT* **59**, 2515 (2005)