

## Solid-phase recrystallization of oxides in the medium of sub- and supercritical water fluid

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Recrystallization of fine-crystalline powders of simple and complex oxides occurs after their formation in a medium of water vapor or water fluid as a result of prolonged exposure at temperatures of 100-400°C and pressures of 1-30 MPa.

Formation of fine-crystalline powders of oxides in a low-density water medium occurs by solid-phase mechanism. The mechanism includes hydroxylation of the oxide structure due to dissociative adsorption of water molecules. Hydroxylated oxides have low temperature resistance, thus at elevated temperature hydroxyl groups are eliminated from the structure, forming water molecules. During the exchange of structural water with environmental water, numerous local rearrangements occur, which determine the appearance of solid-phase mobility [1, 2]. The appearance of solid-phase mobility leads to the ordering of the structure with the formation of well-cut faceted microcrystals. At the same time, due to the action of water, the conditions of structural transformations of oxides are changing dramatically. For example, the temperature of  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> formation decreases from 1200°C to 400°C [3]. In addition, the low water content in the reaction medium (at the level of the adsorbed layer) allows the consolidation of the powder material under significantly milder conditions [4].

The figure shows the change in the average size of the crystals with the exposure of fine-crystalline powder at constant P and T. The change in dispersity is caused by redistribution of mass between the crystals of the

different components of the dimension of the distribution due to diffusion spreading of the crystals with higher mobility of the structures on the surface of the crystal with lower structural mobility.

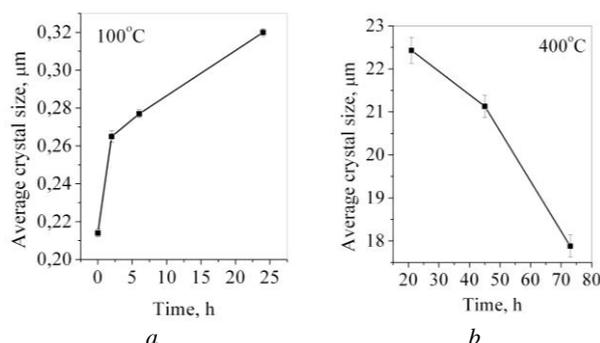


Figure 1. Average crystal size dependence on the time of isothermal exposure in a low-density water medium: zinc oxide (a), corundum (b).

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