Nanostructured surface

"Lotus" effect in amorphous oxide nanoparticles modified by high hydrostatic pressure

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Task-oriented change of the relief geometry allows to control surface wettability that is of great practical importance, for example, at creation of functional surfaces and coatings. One factor of the hydrophobicity of surface is developed topography on the micro or nanoscale level. For controlling of relief geometry of nanoparticles compacts was used high hydrostatic pressure. It was found the change of wettability of surface of compacts which obtain at pressure range of 100-1000 MPa. This change of surface wettability has non-monotonic character with extreme at 600 MPa, where the low surface wettability is observed. Its effect likes to "lotus" effect which is one of the most beautiful and surprising nature phenomena based on an extremely low surface wettability of leaves and petals of some plant species.

For understanding of this phenomenon for compacts of hydrophilic amorphous zirconia nanoparticles the investigation of relief of surface compacts was carried out by scanning electron microscopy and the structure of hydrate shell was estimated by FTIR spectroscopy.

Factors of surface relief of compact were estimated by analysis of SEM data. It is shown that compacts formed under 600 MPa pressure has factors of surface relief above the critical values that may be connected with the change of the motion of nanoparticles relative each to each at pressure of 600MPa.

The reasons of the difference in the ordering of amorphous zirconia nanoparticles in compacts under pressure and extremely change of the surface wettability is discussed.