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Electrical properties of nanocrystalline ZrO_2 at high-pressure
ANNA TREFILOVA — It is shown, that the materials are received from nanocrystallite zirconium oxide have the different properties from bulk material. The combination of external compression and the contribution of a surface create an opportunity of occurrence of the unusual physical and chemical and electrophysical phenomena. Research of such effects is necessary for development of fundamental bases of creation new materials with special properties. We studied correlation between the sizes of crystallite and resistance ZrO_2 at the pressures 22 - 50 GPa and temperatures 77 - 400 K. The dc resistance measurements were carried out in a diamond anvil cell rounded cone-plane type. We found that the transition pressure of ZrO_2 depends on crystallite size. The smaller crystals, the smaller transition pressure. The reduction of transition pressure was observed to 10 nm. However at 10 nm the transition pressure rises steeply. It is possible to suspect, that the surface effects essentially change ZrO_2 conductivity mechanism at high pressures. We studied relaxation processes in ZrO_2 under the high pressures and the room temperature. The analysis of experimental data has shown that the time function of electric resistance most precisely described by exponential function. It can be seen, that relaxation times depend on pressure and crystallite size.

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