Chemistry at extreme conditions: from geosciences to synthesis of new materials

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Studying of chemical reactions in the megabar pressure range, and temperatures exceeding 2000 K is not a trivial task. The amount of reacted material is very small (in the order of a few wt. percent, or, in absolute values, in the order of 10^{-10} g). Despite high temperatures, spatial temperature distribution across the pressure chamber is not homogeneous. The material can be partially, or completely lost when the cell, containing the recovered sample, is opened.

Combination of different modern analytical techniques (synchrotron based X-ray powder diffraction, Mössbauer and Raman spectroscopy, SEM, ATEM, etc.) allows the elucidation of major trends in the behavior of the geophysically and geochemically important metal-oxide (Fe-SiO_2, Fe-Al_2O_3, MgO-FeO, Fe-$MgSiO_3$, for example) systems at pressures and temperatures of the Earth's deep interior. Methodological aspects of investigation of chemical reactions in DACs and in large volume apparatus are also considered.