Knowledge of the physical properties of mantle material is essential for understanding the structure and dynamics of our planet. Large perfect single crystal samples of mantle minerals are necessary for the accurate determination of their physical properties, such as elasticity, plasticity, electrical and thermal conductivity. Therefore the development of a technique of single crystal growth of mantle minerals such as magnesium silicate perovskite, ringwoodite, wadsleyite, and stishovite is foreground aim for me. For this purpose I'm trying to solve following tasks: 1) optimization of assembly for crystal growth in the large volume HPHT apparatuses; 2) searching of favorable physicochemical conditions (pressure, temperature, thermal gradient, solvent) for the bulk crystal synthesis by means of growth from solution.

Dynamics of earth’s interior depends on the rheological properties of its constituent materials. The viscosity of a material is directly related to its diffusion coefficients. The diffusion creep rate can be estimated from the self-diffusion coefficient of the slowest rate controlling species. In the case of silicate minerals, silicon is the rate controlling species. For this reason, we have to measure the Si self-diffusion coefficients in mantle rock forming minerals. Nevertheless, previous measurements of Si-self diffusion coefficient have an uncertainty due to using polycrystalline samples with grain boundaries. Therefore my next aim is determination of Si-diffusion coefficients using the synthesized single crystals.

Laboratory experiments on water transport (i.e., ‘diffusivity’) are critical for providing the kinetic data necessary to predict and to understand actual water distribution in the deep Earth. There are two distinct diffusion processes: chemical diffusion and self diffusion. Chemical diffusion of hydrogen controls water distribution and circulation in the mantle. Self diffusion of hydrogen determines electrical conductivity of mantle minerals. Therefore, in present project I will study hydrogen mobility in the transition zone rock-forming minerals (wadsleyite and ringwoodite) by means of hydrogen diffusion experiments in bulk crystals under high pressures and high temperatures.