EGU21-7530, updated on 19 May 2022
https://doi.org/10.5194/egusphere-egu21-7530
EGU General Assembly 2021
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In situ Raman spectroscopic technique for high-pressure studies of mineral and fluid inclusions formation

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Rapid development of *in situ* experimental techniques provides researchers with new opportunities to model geological processes, which take place deep in the Earth's interior. Raman spectroscopy is considered a powerful analytical tool for investigation of the samples subjected to high pressures in a diamond anvil cell, since in such experiments phase assemblages can be determined in real time using measured Raman spectra.

In this study, we describe experimental methods for *in situ* observation and spectroscopic analysis of fluids and minerals, which constitute environment for diamond growth, at the upper mantle pressure conditions. Experiments were conducted in the externally heated, "piston-cylinder" type diamond anvil cell at pressures exceeding 6 GPa and temperatures up to 600 degree C. Phase relationships and fluid speciation were monitored during experiments to reconstruct the environment and mechanism of inclusions formation. Compared to other analytical tools, commonly used in combination with diamond anvil cell apparatus, Raman spectroscopy offers several advantages, such as short sample preparation time, non-destructive characterization of the phases observed in the sample chamber and relatively short measurement time.

This work was supported by grant No. 20-77-00079 from the Russian Science Foundation.