

Correlation of thermobaric history and elastic properties of dipropylene glycol glasses

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Unlike crystals and liquids, glasses are non-ergodic nonequilibrium systems, which means that their state is not an unambiguous function of external PT parameters, but depends on the time and production protocol. Densified glass, obtained by cooling a liquid at high pressure and then releasing the pressure, has higher density than glass obtained under normal pressure. High-pressure densified propylene carbonate has higher elastic moduli than low-pressure glass [1]. We have studied the influence of thermobaric history on the elastic properties of dipropylene glycol ($C_6H_{14}O_3$) glasses: high pressure glasses (densified) and low pressure glasses (ordinary). To create high-pressure glasses, we compressed the liquid to 1 GPa, quickly quenched it to a temperature of 77 K, and then released the pressure to 0.1 GPa. Low-pressure glasses were created at 0.1 GPa by cooling to 77 K. The studies were carried out using a piston-cylinder high-pressure apparatus [2]. High-pressure densified dipropylene glycol had higher elastic moduli than low-pressure glass. While the difference in the densities of glasses obtained at 0.1 GPa and 1 GPa turned out to be only 5%, the moduli of compacted glass turned out to be significantly higher than that of ordinary glass. For the bulk modulus, this difference was 7%, and for the shear modulus, 30%. During heating before devitrification, the elastic characteristics approached each other, completely coinciding immediately before T_g . The study was supported by the Russian Science Foundation, scientific project No. 22-22-00530.

[1] Danilov I G E and V B 2016 *J. Phys. Chem. B* **120** 7593–7597

[2] Lyapin A Gromnitskaya E D I and V B 2017 *RSC Adv.* **7** 33278–33284