Elastic properties of propylene glycol oligomers in the glassy state and glass-liquid transition

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Propylene glycol ($C_3H_8O_2$) and its two oligomers, dipropylene glycol ($C_6H_{14}O_3$) and tripropylene glycol ($C_9H_{20}O_4$) are molecular glass-forming liquids with glass transition temperatures of 165, 189 and 193 K, respectively [1], [2]. Despite the different number of oxygen atoms, each molecule of these substances has 2 hydroxyl OH-groups, which can organize strong hydrogen bonds between the molecules. Varying the lengths and masses of the molecules, but leaving the number of OH groups constant per molecule, we change the "effective concentration" of the hydrogen bonds in the substance. The purpose of our work is to determine the effect of the fraction of hydrogen bonds on the elastic properties of molecular glassformers under pressure. The studies were carried out up to 1.8 GPa in the glassy state and at isobaric heating during the glass-liquid transition. At the atmospheric pressure, the elastic moduli of dipropopylene glycol and tripropylene glycol are almost identical, while the moduli of propylene glycol are higher by 15 percent for G and by 10 percent for B. The fact that propylene glycol has the largest specific number of hydrogen bonds leads to strengthening of the modules. The bulk moduli of di- and tripropylene glycol are very similar, and the modulus B of propylene glycol is much higher. This work was supported by the RSF Grant 22-22-00530.

[1] Köhler M, Lunkenheimer P, Goncharov Y, Wehn R and Loidl A 2010 *J. Non-Cryst. Solids* **356** 529–534

[2] Tsukada S, Ike Y, Kano J and Kojima S 2006 *Material Science and Engineering A* **442** 379–382