Pressure media for high pressure experiments

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Hydrostatic pressure is one of essential thermodynamic parameters in materials research. Compared to other parameters, which can be changed relatively easily nowadays (temperature, magnetic field), pressure is the most complicated parameter to change. Sophisticated pressure cells and pressure exchange media responsible for an equal redistribution of pressure within the sample space are necessary [1]. Focusing on liquid pressure media, topic of the presented work, they tend to solidify at specific (high) pressure. To maintain hydrostatic conditions even in pressures of several GPa, new pressure media with higher solidification pressure are required.

In this work, we studied the properties of pressure media Daphne 7373 and Daphne 7474 compared to the results of previous works. The solidification of Daphne 7373 [2] was confirmed in pressure of 2.2 GPa at room temperature. Furthermore, the quality of hydrostaticity was studied upon reaching solidification by pressure or temperature change. Our results confirmed that Daphne 7373 remains perfectly hydrostatic below solidification temperature. The pressure drop at low temperatures was determined for various pressure points. Daphne 7474 [3], reported to solidify at 3.7 GPa at room temperature, has shown a good hydrostaticity during the whole experiment, i.e., up to 3 GPa. Temperature dependence of solidification was inspected by strain gauges, resulting in a p-T phase diagram of Daphne 7474 below room temperature. Measured data together with high temperature data [2] were extrapolated [$Tc/K = (-0.024\pm0.005)p^2/kbar^2+(4.86\pm0.37)p/kbar+(156.7\pm5.1)$] to estimate the border between liquid and solid state of pressure medium in broader p-T range. The compressibility of both pressure media was also determined.

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