As the sample expands or contracts, the vertical height of a magnet floating on top of the mercury is monitored with a transducer. Changes in transducer voltage are approximately proportional to changes in sample volume.

The system is placed in a copper can in a temperature-controlled ethanol-water bath, and the entire apparatus is kept in a heavily-insulated cooler. A chiller is used to control temperatures down to 200 K below that, cooling is done with liquid nitrogen.

**Ice-Ih Regime: Determining the Liquidus Temperature**

The results for a run with a 40-wt.% methanol/water solution at a nominal pressure of 50 MPa are shown in Fig. 3.

![Figure 3: A run at 50 MPa. The vertical axis shows the transducer voltage, which is approximately linearly related to volume, and the horizontal axis shows temperature.](image)

The system started as a warm homogeneous liquid at 280 K (point a). As the system cooled to (b), the volume decreased due to thermal contraction. From (c) to (d), rapid crystallization of Ice-Ih was observed, accompanied by significant increases in volume, though the sample remained partially liquid throughout. The crystallization was reversible upon warming, until the last crystals dissolved around point (e), slightly below 235 K. The final approach to equilibrium is quite slow.

**Results**

The observed transition temperatures as a function of pressure are shown in Fig. 7. Overall, the liquidus temperature appears to decrease slowly with pressure, though we only have data at relatively low pressures. Although there are two different transition temperatures for methanol apparent in Fig. 1, we were unable to distinguish two separate transitions in these experiments. The observed freezing temperature appears to follow the trend for pure methanol; the transition from the Ice-Ih phase to the Ice-II phase does not appear to play a significant role. We do observe Ice-Ih at slightly higher pressures than has been reported for pure water ice.

![Figure 7: Transition temperatures as a function of pressure for a 40-wt.% methanol-water mixture.](image)

**References**
