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two atoms in the liquid. With increasing density produced by changes in temperature and pressure along the normal vapour pressure curve, there is a slight shift in the maximum to smaller radial spacing while the form of the curve changes only slightly. Density changes induced by pressure cause marked changes in the distribution function and presumably in the short range order. The first maximum increases in height and tends to move to smaller radial spacings while there is a marked increase in the depth of the valley following the first peak.

The position of the maximum in $r\,\rho_{(r)}/\rho_0$ together with the number of neighbours under the first and second coordinate shells has been determined for each of the curves. For changes in density from 0.095 to 0.184 gram/cc the position of the maximum shifts from $3.9_4$ Å to $3.5_5$ Å while the number of first neighbours increases from $6._5$ to $8._5$ atoms and the number of second neighbours decreases from $9._2$ to $5._0$ atoms. These results indicate that changing liquid density causes a change in the atomic separation together with a change in the atomic arrangement in the liquid and lends further support to the hypothesis (1) that density changes in liquid helium cannot be simply explained in terms of a simple dilation of a basic structure but a change in the form of the atomic arrangement must also be considered.

The neutron diffraction patterns for six samples of solid helium were measured. Four of these were measured at $1.1_5$°K and 66 atmospheres while the fifth and sixth were measured at $1.8_8$°K and at 66 and 69 atmospheres respectively. In all six lines were observed in the patterns. While the positions of the lines were reproducible their relative intensities were not, from which it was concluded that the patterns were polycrystalline. The average position of the lines observed at $1.1_5$°K and 66 atmospheres have been fitted by a hexagonal close packed structure in which $a_0 = 3.53 \pm .03$ Å and $c_0 = 5.76 \pm .05$ Å. The density of the solid at $1.1_5$°K and 66 atmospheres corresponding to the deduced structure is $0.214 \pm 0.006$ gram/cc. The mean isothermal compressibility of the solid at $1.1_5$°K between the solidus and 66 atmospheres is $3.1 \pm 0.8 \times 10^{-3}$ atmospheres$^{-1}$.


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## TENSILE STRENGTHS OF LIQUIDS AT LOW TEMPERATURE*


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Measurements by a large number of investigators show that most pure liquids near room temperature have tensile strengths of considerable magnitude (1). However, in all cases the values are considerably lower than those estimated from the theory which assumes that the liquid fracture takes place simultaneously into two portions along a plane surface (2, 3). Fisher (4) has pointed out that such a theory should predict values which are too large because a liquid under high enough negative pressure should become metastable and in time would change spontaneously into a two phase-system of liquid plus vapor, that is, vapor bubbles should form and grow until the liquid fractures under the negative pressure. However, when this is taken into account the theoretical values are still much higher than those found by experiment. If nuclei exist around which vapor bubbles may form in the liquid or the interface between the liquid and its container, then it is easy to account for the low experimental values.

In the present experiments an attempt is made to measure the tensile strength of some liquids at low temperature in the hope that better agreement with theory might be found. In order to minimize the effect of nuclei, especially those caused by cosmic rays and other background radiation, the tension was applied to the liquid for periods not greater than $10^{-2}$ sec. and care was taken to work with as pure liquid as possible.

The experimental method consisted in applying the stress to the liquid by means of a known linear deceleration to the liquid. The liquid completely filled an inverted glass U tube. The two arms of the inverted U tube were vertical and their open ends extended just below the liquid surface. The tube was 5 mm. I. D. and each arm was 10 cm. in length. The inverted U tube was driven downward by a spring mechanism and suddenly but uniformly decelerated. This applied the desired stress to the liquid in the curved part of the U tube. The deceleration could be determined from the trace on a rotating disc of a small stylus attached to the U tube support and the emf induced in a stationary coil by a small magnet also attached to the U tube support.

The preliminary values in atmospheres required to produce rupture are as follows: argon 10; helium II 0.1; nitrogen 8; and oxygen 14. The above value found for helium II is slightly below that found by the centrifugal method (5), while the value for nitrogen is greater than that found by the bellows method. (6)

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