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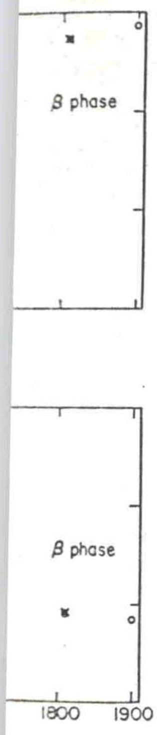

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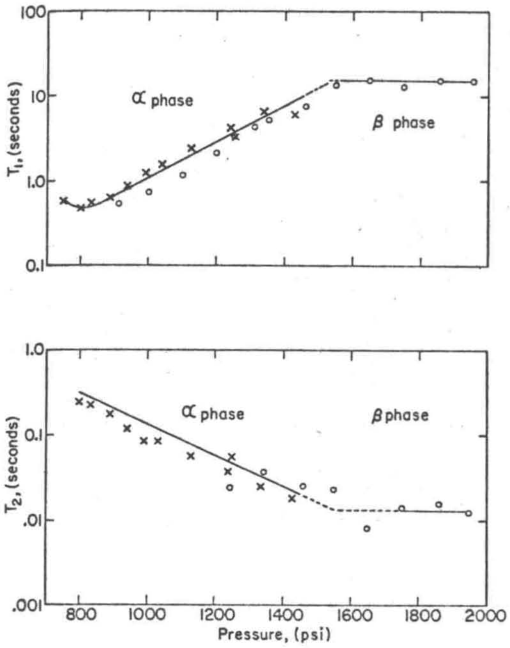

FIG. 2. Nuclear spin relaxation times as a function of pressure at 1.37°K, indicating a discontinuity in their rate of change with pressure at the α-β phase boundary. Circles and crosses represent, respectively, data taken while increasing and decreasing the pressure.

as the pressure changes near the liquid-solid phase boundary. Furthermore, there appears to be a discontinuity in the rate of change with pressure of T_1 and T_2. The pressure was measured to the accuracy obtainable with an Ashcroft Bourdon gauge.

Results consistent with this picture have been obtained at both higher and lower temperatures. Measurements of T_1 were made as low as 0.8°K, using a He^3 refrigerator, by both free-precession and steady-state methods. However, at this temperature T_1 was 26 minutes at 1300 psi, and apparently still increasing exponentially with pressure. Consequently, T_1 became so long as to make measurements at higher pressures difficult with the apparatus at hand. Since the discontinuity of the relaxation times vanishes near the temperature at which Grilly and Mills found the volume change approaching zero, a more detailed investigation of the temperature dependence of the effect is planned.

Several different constant-volume curves were measured. In general, in the temperature range investigated, the curves displayed the characteristics predicted by the semiclassical relaxation theories[5,6] (see Fig. 3). T_1 passes through a minimum as the temperature decreases and approaches an exponential dependence on $1/T$ near $T = 1.5$°K. T_2 displays an exponential dependence on $1/T$. This information is interpreted as an indication that in these temperature regions the relaxation is due primarily to an activated diffusion.[7] Thus $T_1 \propto 1/D$ and $T_2 \propto D$, where the diffusion coefficient D is of the form $D = D_0 \exp(-E/kT)$. Consequently, plotting the logarithms of T_1 and T_2 against the reciprocal of the temperature, the slope of the straight line part of the plot should be a measure of the activation energy E.

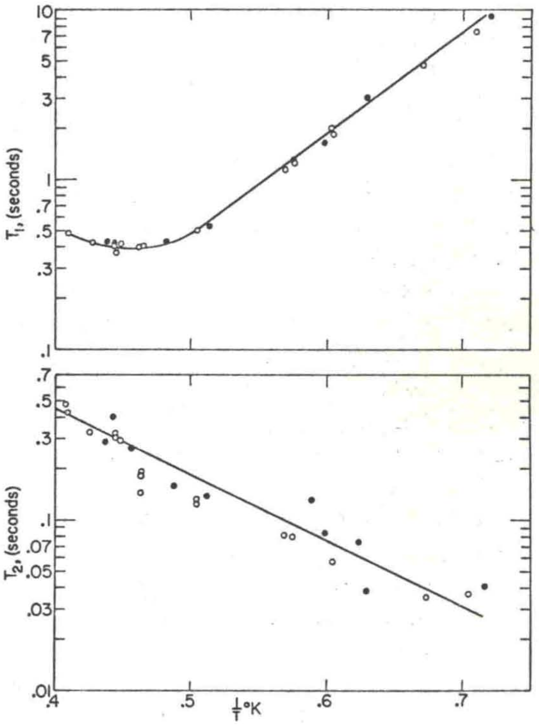

FIG. 3. Relaxation times as a function of the reciprocal of the temperature at a constant density of $\rho = 0.144$ g/cm^3, indicating an exponential dependence at temperatures here represented. Open circles and dots represent data taken on two different runs.

The energies determined from the T_1 data in this way were 12.3°, 14°, and 12.5°K for densities of 0.151, 0.144, and 0.142 g/cm^3. The T_2 values were consistently 3°K lower, for reasons which are not at present understood. The densities given above were estimated from the information given by Grilly and Mills and the known temperatures and pressures at which the constant-volume curves were started.

With a different apparatus some preliminary results have been obtained down to 0.15°K. A