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e beta group feeding this state band. The intensities sertain to make much use

2+ [4,0,2] particle state, out the correct excitation the decay scheme, levels [4,0,2] particle state and all three levels involve a

sfactory in that it uses all gy region, it also demands rnative to the use of the ,1,3], is to consider levels ation levels based on the as rotational states based ately, there does not seem bilities on the basis of the

and Dr. Boehm for their ted to Miss Anne Staveley with the recording of the edge the generosity of the owship. Financial support rch Council of Canada.

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COMPRESSIBILITY OF LIQUID He^{4 1}

M. H. EDWARDS AND W. C. WOODBURY

ABSTRACT

The refractive index *n*, density ρ , and isothermal compressibility $k_T = (1/\rho) \times (\partial \rho / \partial P)_T$ of liquid He⁴ have been measured along isotherms between the saturated vapor pressure and 4.5 atmospheres at 3.0°, 3.5°, 4.0°, 4.5°, and 5.0° K. The liquid was compressed in an optical cell 9.58 cm long in a Jamin interferometer. Changes in density were inferred through the Lorenz-Lorentz equation from refractive index changes measured with a photomultiplier fringe recorder. One fringe corresponds to a change in refractive index of $(5.699 \pm 0.003) \times 10^{-6}$ in this apparatus. Densities range between 0.0995 g cm⁻³ at 5.0° K at the saturated vapor pressure and 0.1501 g cm⁻³ at 3.0° K and 4.5 atmospheres pressure. Compressibilities range between 65×10^{-8} cm² dyne⁻¹ at 5.0° K at the saturated vapor pressure and 1.16×10^{-8} cm² dyne⁻¹ at 3.0° K and 4.5 atmospheres pressure. The limiting liquid structure factors for zero-angle X-ray scattering and for coherent scattering of slow neutrons have been calculated from these density and compressibility measurements. In addition, the ratio of heat capacities has been calculated at 3.0°, 3.5°, and 4.0° K where other measurements of the velocity of first sound are available.

INTRODUCTION

A study of the refractive index of He⁴ (Edwards 1956, 1957, 1958) has been extended to give further information on the liquid density. The refractive index *n*, the density ρ , and the isothermal compressibility $k_T = (1/\rho)(\partial \rho/\partial P)_T$ of liquid He⁴ have now been measured along isotherms between the saturated vapor pressure (SVP) and 4.5 atmospheres at 3.0°, 3.5°, 4.0°, 4.5°, and 5.0° K. The complete absence of "dead space" corrections makes this optical method particularly attractive at temperatures and pressures where the gas in the connecting tubing is a large correction for direct pycnometric methods. The liquid density has not previously been measured above 4.2° K at any pressure above the SVP, nor has the liquid compressibility been determined directly at any temperature or pressure.

A knowledge of the isothermal compressibility of the liquid is needed for the interpretation of the scattering of X rays through small angles, and the coherent scattering of slow neutrons, since such scattering is attributable to liquid density fluctuations. Furthermore, the liquid compressibility is a most important factor in the electrostriction calculations involved in the analysis of the movement of ions in liquid helium (Atkins 1959; de Boer and 't Hooft 1961).

2. INSTRUMENTATION

The liquid was contained and compressed in an optical cell 9.58 cm long in a special optical cryostat mounted on a Jamin interferometer (Edwards 1956, 1957, 1958). A shift of one fringe in this apparatus implies a refractive index

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