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Phonon Dispersion Measurements on a Krypton Single Crystal*

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ABSTRACT

Phonon dispersion relations for the symmetric [100], [110], and [111] branches in fcc krypton have been measured by triple-axis neutron spectrometry. Measurements were carried out at 79°K on a single crystal sample grown from the melt at a pressure of 2.31 kbar.

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The phonon dispersion relations in fcc krypton have been measured on the triple-axis spectrometer at the Brookhaven High Flux Beam Reactor. The single crystal used for the experiment was grown from the melt at a pressure of 2.31 kilobars in an aluminum alloy pressure cell incorporating a nucleation tip at the bottom. The cell was cylindrically shaped with an inside diameter of 12 mm and an outside diameter of 47 mm. The growth process was carried out in a temperature-controlled dewar with heaters appropriately placed so as to prevent blockage of the high pressure tubing and to maintain a suitable temperature gradient along the sample holder. After complete solidification the sample was annealed for three weeks at 166°K, i.e. about 10° below the 2.31 kbar melting temperature, and then was cooled to 79°K, the temperature at which the dispersion curve data were taken. This process yielded a crystal with a measured lattice parameter of 5.725 ± 0.010 Å. On the basis of this lattice parameter, compressibility data, and previously reported values of the lattice parameter at 79°K and 1 atmosphere,¹ it is estimated that the sample pressure decreased to about 0.3 kbars in cooling to 79°K.

The size of the krypton crystal, estimated by beam masking experiments, was approximately $8 \times 8 \times 11$ mm³. The small size of the crystal, for an inelastic neutron scattering experiment, has somewhat limited the accuracy obtainable in the present investigation. The quality of the crystal was