PROC. JSSF-2, KYOTO, 1980
J. PHYS. SOC. JPN. **49** (1980) SUPPL. B, p. 44.

Brillouin Scattering in NH_4Cl under High Pressure

Tomoyuki HIKITA, Makoto KITABATAKE and Takuro IKEDA

Department of Applied Physics, Faculty of Engineering, Tohoku University, Sendai, 980

Ammonium chloride undergoes an order-disorder phase transition of the first order at atmospheric pressure. The transition changes to that of the second order under hydrostatic pressure higher than 1.5 kbar (TCP). Various experimental studies have been made on NH_4Cl with special attention to the TCP.

Ultrasonic studies have been extensively perfomed, and the dynamic behavior was analysed.[1] Brillouin and Rayleigh scattering at atmospheric pressure has been reported.[2] A marked dispersion effect is known between the ultrasonic and the hypersonic velocities. It is of much interest to investigate the temperature dependence of the acoustic phonon velocities in the hypersonic region under hydrostatic pressure around the TCP of NH_4Cl.

Figures 1 and 2 show the temperature dependence of the Brillouin shift of the longitudinal $((c_{11}+c_{12}+2c_{44})/2)$ and the transverse (c_{44}) phonons propagating along $\langle 110 \rangle$ for four isobars, respectively. The temperature dependence of the transverse mode at atmospheric pressure agrees well with the result of Lazay *et al.* However, a dip-like behavior for the longitudinal mode near T_c was not observed in our study. It is noted that both longitudinal and transverse modes behave in a similar manner. The velocity increases almost linearly with decreasing temperature in the disordered phase and shows a discontinuous increase at T_c, and then increases like the order parameter. The discontinuity in the velocity seems to vanish at 2.3 kbar where the transition is of the second order.

The Rayleigh intensity was also measured. The polarized intensity shows an anomalous increase at T_c which is enhanced under pressure. The depolarized intensity, on the other hand, shows only a stepwise increase at T_c.

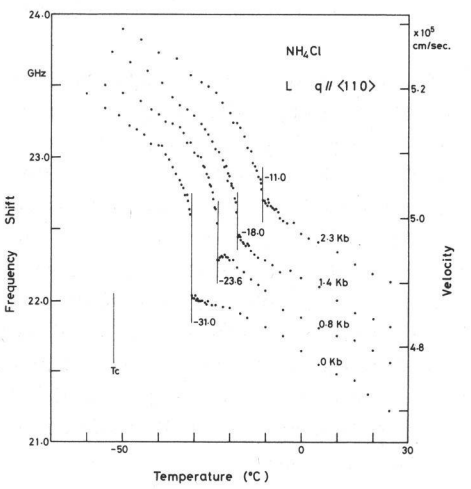

Fig. 1. Brillouin shift of the longitudinal phonon mode along $\langle 110 \rangle$ in NH_4Cl as a function of temperature at various hydrostatic pressures.

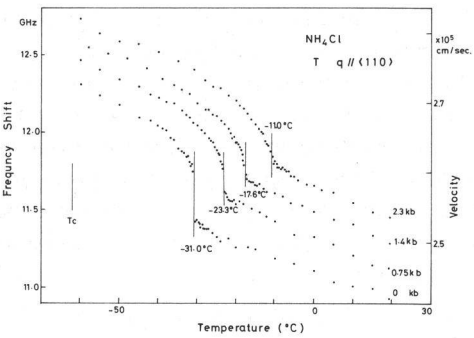

Fig. 2. Brillouin shift of the transverse phonon mode propagating along $\langle 110 \rangle$ in NH_4Cl as a function of temperature at various pressures.

References

1) R. C. Leung, C. Zahradnik and C. W. Garland: Phys. Rev. **B19** (1979) 2612.
2) P. D. Lazay, J. H. Lunacek, N. A. Clark and G. B. Benedek: *Proc. Int. Conf. on Light Scattering Spectra of Solids* (Springer, 1969) p. 593.