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LETTER TO THE EDITOR

Anisotropy in the resistivity of $NbSe_2$ with pressure

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Abstract. The anisotropy in resistivity of $NbSe_2$ decreases with pressure, reaching a value of about five at 45 kb. A crystallographic phase change occurs at a pressure of 33 ± 3 kb.

$NbSe_2$ is a metal belonging to the family of transition metal dichalcogenides which form layer-type crystals: details of the crystallography may be found in the review by Wilson and Yoffe (1969) together with a simple energy band scheme. In this band model the uppermost valence band, made up from the d_z^2 orbitals of the Nb atoms, is only half full, thus accounting for the metallic properties of $NbSe_2$. The most common polytype of $NbSe_2$ is the two layer, or 2H modification where the Nb atoms in neighbouring layers are directly above one another in the c direction. Because of the weak interlayer forces a relatively large increase in the interlayer Nb–Nb overlap is expected under pressure. There has been recent interest in the rapid increase of the superconducting transition temperature with pressure (Jerome *et al* 1971, Jones *et al* 1972). We report here on the behaviour of the resistivity of the 2H form of $NbSe_2$ under pressure.

The $\rho \perp c$ (along the layers) was measured using a standard four-probe technique with silver-dag contacts. For measurements of $\rho \| c$, the technique of Edwards and Frindt (1971) was used: this involves small voltage probes partially cleaved from the body of the crystal. The samples used were hexagonal platelets typically 1 to 2 mm across with thicknesses of the order of 0·15 mm for $\rho \| c$ and 0·05 mm for $\rho \perp c$.

Two types of apparatus were used for high pressure measurements. Hydrostatic pressures up to 15 kb were applied in a piston and cylinder apparatus (Pitt and Gunn 1970) using a 50:50 mixture of amyl alcohol and castor oil as the pressure transmitting medium. Here only slight hysteresis was observed and the sample resistivity returned to its original value for both orientations when the load was removed. Pressure measurements to 100 kb were made using a Bridgman anvil apparatus described by Pitt (1968): the crystal was potted in epoxy resin at the centre of a MgO-loaded epoxy ring.

The behaviour of the resistivity perpendicular to the crystal c axis with pressure at room temperature is shown in figure 1. After an initial decrease, ρ/ρ_0 $(\perp c)$ tends to level off until another decrease is observed at about 30 kb. Here ρ_0 corresponds to the resistivity at atmospheric pressure. A much greater effect is observed for $\rho/\rho_0(\| c)$, also shown in figure 1. Here $\rho \| c$ is decreased to $\frac{1}{10}$ of its atmospheric pressure value at a pressure of 45 kb. As shown in the figure 1 inset, the anisotropy in resistivity $\rho \| c/\rho \perp c$ decreases with

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