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(prepared by melting and cooling CuCl powder) were also carried out inductively at low temperature for $P \leqq 20$ kbar by a self-clamp technique (Chu *et al* 1968).

Schematic results for one of the CuCl single crystals are shown in figure 1. The resistance *R* decreased initially (presumably due to improvement of contacts) and then increased only slightly (perhaps due to the freezing out of the defects) with increase of pressure up to 40 kbar. Beyond and close to this pressure, *R* started to oscillate between $\sim 30 \times 10^6\ \Omega$ and $\sim 6 \times 10^3\ \Omega$. After very slowly cycling the pressure back and forth through 40 kbar by $\leqq 2$ kbar, *R* eventually dropped to $\sim 3\ \Omega$ including the contact resistance. Further increase of *P* to ~ 55 kbar did not induce any significant change in *R*. However, for higher *P*, *R* increased rapidly, finally reaching a value of $\sim 3 \times 10^6\ \Omega$ at ~ 75 kbar.

It should be noted that not all runs were successful. Eighteen runs excluding those caused by pinching or shorting of leads were made, and large drops in *R* were detected in only seven of them. We attribute this to the chemically unstable nature of, and the defects in, the samples. Six out of the seven successful runs were made, with five clear and one semiclear crystal, within two weeks after preparation, while most of the failing runs occurred in crystals prepared more than five weeks prior to the run, or in semiclear crystals. We also noticed that violent explosions occurred at ~ 40 kbar in both increasing and decreasing pressure cycles for many cases. This may be attributed to the drastic volume change (or latent heat) accompanying the transformation into the metallic state similar to the case of Sm-monochalcogenides (Jayaraman 1971). A large AC susceptibility jump over a 9 K range was also detected around 85 K and at 20 kbar in the fused polycrystalline sample. As the pressure decreased, the size of the jump decreased and the width increased rapidly without significantly shifting the temperature of the midpoint of the susceptibility jump. The anomaly is absent at 1 bar.

3. Conclusions

The results shown in figure 1 and discussed above show there is an insulator–metal transition in CuCl at 40 kbar and room temperature which is then followed by a metal–insulator transition at somewhat higher pressure. Based on the preliminary susceptibility data, the critical pressure required to induce the transformation may decrease with temperature. These observations are consistent with previous electrical study of compressed and fused CuCl powder at high pressure by Bradley *et al* (1969). Their failure to detect large conductivity near 40 kbar can easily be attributed to the possible large contact resistance between CuCl particles and their experimental conditions.

Only tentative speculations as to the nature of the insulator–metal transitions are possible at this time although it seems possible they result from a progressive change from covalent- to metallic- to ionic-bonding. Detailed investigation of the nature of the CuCl collapsed metallic phase by a modified high pressure rig is in progress.

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