characteristic of the shock response of that solid. At the same time the plastic strain is gradually accommodated by dislocation glide, multiplication, nucleation, and by twinning. If such behavior occurs in the first 20 μm of shock-wave propagation in the silver used, it is not difficult to imagine an average elastic stress over distance and time which is a sizeable fraction of a 100 kbar driving stress.

Note should be taken that some very pure metals are not elastic-plastic in behavior but visco-plastic. They begin to flow at a measurable rate as soon as a small stress is applied, and the rate increases in proportion to stress until some rate limit is reached. Gilman (1968) showed that this results in very rapid plastic relaxation of shear stress. Whether this occurs in the silver used here is not known.

G. Model for Effect of Purity on Shock Resistivity

In this section a model based in stress relaxation processes is developed for the purity effect on shock resistivity. Fig. 10 shows the effect of purity on resistivity results. A greater deviation from hydrostatic resistivity occurs for the more pure silver (W3N). Resistance ratios between room temperature and 4.2°K indicate that W3N silver specimens have an impurity concentration about 45% less than MRC specimens. As mentioned in Sec. II.D, MRC silver was specified as 5N and W3N silver as 3N pure by the supplier.

This effect of purity is opposite to low strain rate deformation results where, when a purity effect is noted, there is more resistivity change for lower purity material (Blewitt et al., 1955; Tanaka and Watanabe, 1972; Basinski and Saimoto, 1967).

Effect of purity has been noted in other shock experiments. Experiments in lithium fluoride showed tensile yield stress to increase smoothly with initial defect concentration (either impurity atoms or irradiation-induced point defects) (Asay et al., 1972). Shock experiments on the same materials showed precursor decay rate to have a minimum for an intermediate concentration of 210 ppm divalent impurities. It is asserted that dislocation mechanisms for plastic flow at very high strain rates are different at higher and lower defect concentrations. At concentrations higher than 210 ppm the dominant mechanism is considered to be heterogeneous nucleation of dislocations at impurity clusters. At lower concentration dislocation multiplication is the dominant deformation mechanism.

If we take these results over to silver we would expect higher elastic limit values after relaxation for the less pure silver (MRC). This would imply greater plastic work and hence higher defect concentrations for it, contrary to the present resistivity experiments.

A more fruitful way of looking at it is to speculate that W3N foil impurity concentration corresponds to the level for minimum precursor decay rate in silver. If we also suppose that significant relaxation is going on in the first 20 μm of travel, we will expect higher transient elastic stress levels in the W3N foils than in the MRC foils (Fig. 16). Let the