5 Kbar

lines at 2,6,10 Kbar

10 Kbar

lines at 2,6,10,15,20,24 Kbar

20 Kbar

lines at 2,6,15,24,33,37 Kbar

Fig. 10   Pressure contours - TlBr

Fig. 11   Pressure gradient at 5, 10, 20 and 40 kbar

solution of this problem later when compressibility data is used to derive a pressure gradient profile.

An example of the effect of the alkali halide used as a diluent is given in Fig.14. The least compressible (and perhaps least plastic) material, LiF, gives a flatter distribution since some resistance is offered to the uniform redistribution of material in the cell, while the curve for the more compressible KBr is more nearly parabolic.

DISCUSSION

The empirical pressure distribution found in these studies

$$P = k \, (\Delta r)^2$$

is considerably different from that predicted by stress analysis, although a pressure increase toward the center is predicted in both cases.

The stress-analysis approach is limited by the complexity of the differential equations derived to include the factors known to affect the pressure distribution. In order to get solutions of these equations, assumptions or approximations must be made with respect to one or more of the variables.

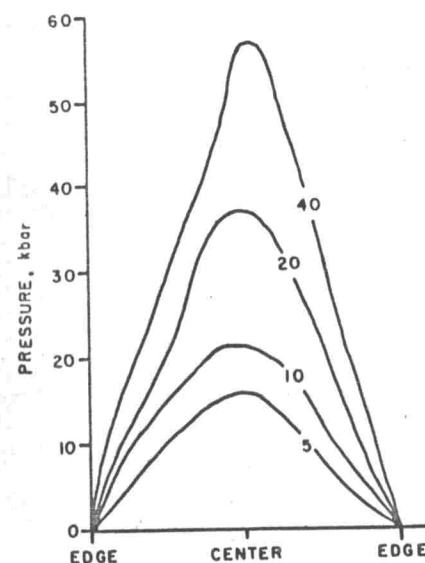It occurred to us that the pressure distri-

bution might be related to some experimentally determined property of the material being investigated, such as the compressibility. While these data are not available for pure nickel dimethylglyoxime, they are available for the alkali halides which we used as diluents. At diluent concentrations of 70 - 80 percent, the mixtures behave considerably different from pure nickel dimethylglyoxime and not unlike the pure alkali halide used as the diluent. Therefore, an attempt was made to determine the expected pressure distribution from compressibility data on the alkali halides.

If a pressure gradient exists within the sample wafer compressed between the diamond anvils, a compressibility gradient must also exist within the wafer, since the compressibility of a material is known to be a function of the pressure. For most materials, therefore, we would expect the material in the center of the diamond to be less compressible (although more compressed, compact or of higher density) than material nearer the edge of the diamonds which is at a lower pressure. Since the compressibility of many materials is known as a function of pressure, we should be able to determine the compressibility distribution between two known pressures. In our experiments, we know the pressure at the edge approaches 1 atm and, in addition, we have a reasonably accurate measure of the applied pressure, P_a, from the compression of the calibrated spring.

The instantaneous compressibility, k, is defined as

$$k = -1/V \, (\partial V/\partial P)_T$$