

Fig. 12 Pressure versus $(1-r^2)$ at 5, 10, 20 and 40 kbar

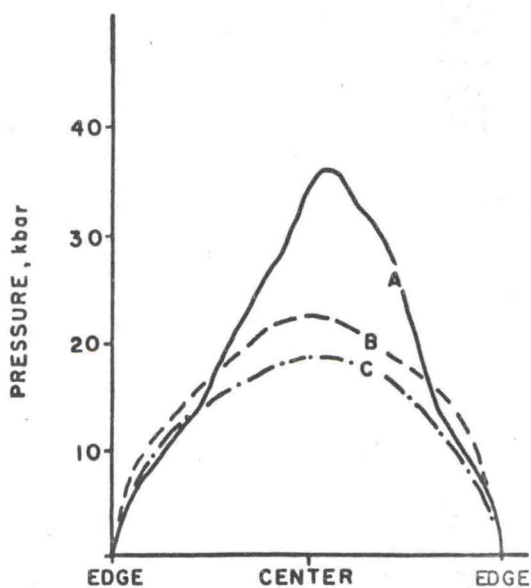


Fig. 13 Effect of diluent concentration of pressure gradient, — 5 parts NaCl by weight, - - 3 parts NaCl by weight, ··· 2 parts NaCl by weight

but at higher pressures where V becomes large it has become customary to define a compressibility, β , as

$$\beta = -1/V_0 \left(\frac{\partial V}{\partial P} \right)_T$$

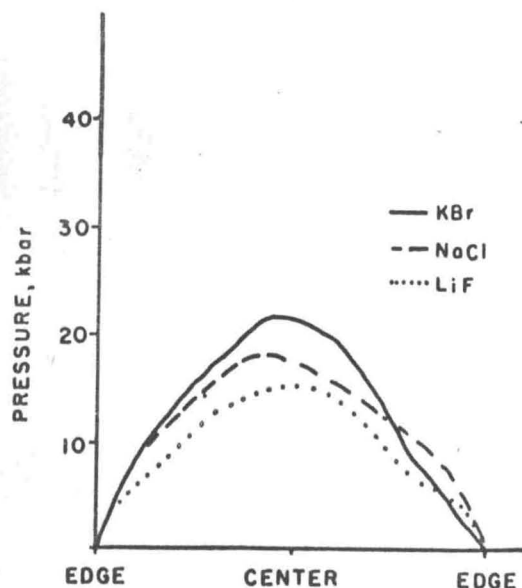


Fig. 14 Pressure gradient with different diluents, all diluents at 3 parts by weight

since the volume at 1 atm is well known and this definition lends itself more readily to an accurate experimental determination. In addition, this value is of more importance to the engineer who is particularly interested in compressibility data. Thus, the compressibilities in the literature are β -values, although they are often reported in the form

$$-\Delta V/V_0 = aP - bP^2 \text{ from which } \beta = a - 2bP \quad (1)$$

Values of $\Delta V/V_0$, a and b are available for some representative materials at 30° as well as $\Delta V/V_0$ values for some of the alkali halides at pressures from 5 to 50 kbar at 20° . Good compressibility data above these pressures are not available so that it is difficult to establish a good empirical relation over a very wide pressure range. At 30 to 50 kbar the bP term of relation (1) is already quite important. A theoretical treatment of compressibility based on finite-strain theory requires an even greater pressure dependence (17). Thus, the lack of good compressibility data prevents a detailed evaluation of the equations derived below at applied pressures greater than 20 kbar. (Unfortunately, experimental factors discussed earlier limit the evaluation at pressures of 10 kbar or less.)

Let us consider a confined sample in the form of a cylindrical wafer mounted between nondeformable diamond anvils with radius, r_0 , separated by a distance, h , at an applied pressure, P_a (see Fig. 15). Now the volume, V , may be expressed