It bears a close relation to $\beta'$, the *specific compressibility* of the solution, which differs from $\beta$ and is defined by equation (8). From equations (8), (13) and (34) it follows that

$$\bar{\beta}_2' = \beta' + x_1 \left(\frac{\partial \beta'}{\partial x_2}\right)_P \qquad (35)$$

This expression might have been used for the definition[26] of $\bar{\beta}_2'$.

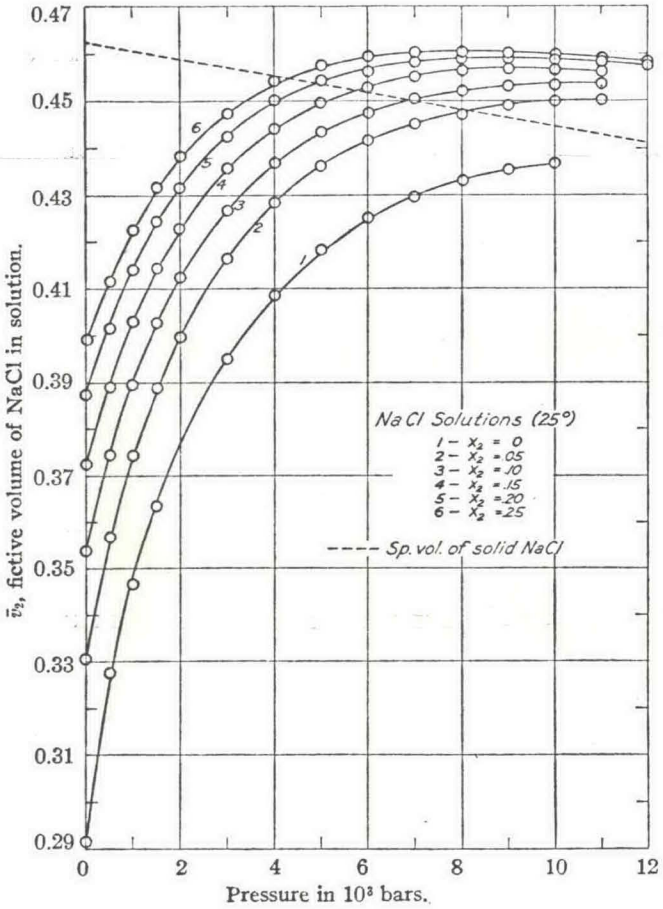


Fig. 8.—The fictive volume of sodium chloride plotted as a function of pressure for various concentrations. The dotted line shows the specific volume of solid sodium chloride under pressure.

It is evident, from equation (34), that $\bar{\beta}_2'$ may be determined by differentiating any of the above equations used for calculating $\bar{v}_2$ from $\Delta v$ or

[26] A third way of defining $\bar{\beta}_2'$ is suggested by the fact that if we substitute (12) in (34), reverse the order of partial differentiation, and make use of the equality $V = mv$, we obtain $\bar{\beta}_2' = \partial(m\beta')/\partial m_2$, in close analogy with the definition of $\bar{v}_2$, according to which $\bar{v}_2 = \partial V/\partial m_2 = \partial(mv)/\partial m_2$.



$k$ (Nos. 20, 22, 23, 25, 27 or 28). With sufficient accuracy for some purposes it may also be obtained from the tabular differences of $\bar{v}_2$. This method was used in order to plot the curves shown in Fig. 9—except at low pressures, for which $\bar{\beta}_2'$ was calculated by differentiating equation (23). The increase in $\bar{v}_2$ under pressure, mentioned above, obviously means that $\bar{\beta}_2'$ is negative. In dilute solutions it has a large negative value comparable in magnitude with the compressibility of water, but of opposite sign; only in concentrated solutions at pressures near the upper end of the experimental range does it change sign and acquire a slowly changing positive value.

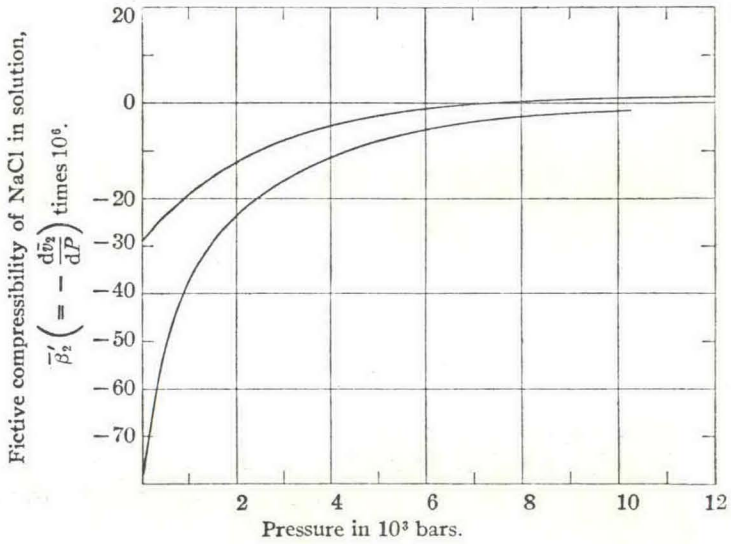


Fig. 9.—The fictive compressibility of sodium chloride in solution. Except at very high pressures this is *negative;* that is, $v_2$ is increased by pressure. The lower curve is for $x_2 = 0.25$, and the upper for $x_2 = 0$.

The fictive compressibility, $\bar{\beta}_1'$, of the water in solution may be computed from equations similar to (34) or (35) but with opposite subscripts. In sodium chloride solutions at 25° $\bar{\beta}_1'$ does not differ notably from the compressibility of pure water; moreover, $\bar{\beta}_1'$ is always greater than $\beta'$ for the solution and less than $\beta'$ for pure water, at the same pressure.

## Determination of Equilibrium by the Thermodynamic Method

**Calculation of $\mu_1$ and $\mu_2$.**—As explained in the introduction the equilibrium between the various phases in a system depends upon the values of the chemical potential, $\mu$, for each component in each phase,[27] and the $\mu$'s

[27] Instead of the potential, $\mu$, we might have used the activity, $a$, which is related to $\mu$ as follows: $d\mu_n = (RT/M_n)d \ln a_n$, $R$ being the gas constant, $M_n$ the (arbi-