copper to be $\sim 2 \cdot 6\, n$ volts, where n is the fraction of charge in a copper polyhedron, transferred from a zinc cell. The perturbing potential used was that due to the charge density of a $4s$ hydrogen-like wave function, and the wave function of the hydrogen-like $1s$-state was assumed for the K-level. The maximum change in width of the energy band for copper in brass, that is, the difference in widths of the band in pure copper and that of very dilute copper in zinc solution, is $\sim 0 \cdot 9$ eV. Assuming that the electrons around the zinc and copper atoms have their energies distributed over a free electron spectrum based on respective ground-state energies[2], this change in width corresponds to an electron transfer of $\sim 0 \cdot 73$ electron into a copper cell for very dilute copper in zinc. The associated energy change of the copper K-level is thus $\sim 1 \cdot 9$ eV. Now the Fermi energy of the copper band will have its absolute energy raised by more than the increased width of the band, since it is estimated that the ground-state energy is itself raised by $\sim 1 \cdot 5$ times the increase in width of the Fermi band[2]. The Fermi energy will thus be raised in energy by an amount $\sim 2 \cdot 35$ eV., so that both it and the K-level increase in absolute energy (relative to an electron at rest in free space) by the same order over the whole range of alloys. In this case the emission wave-lengths for transitions from the top of the Fermi band to the K-shell will stay nearly constant with alloying, and the broadening of the Fermi band will appear as an increase in long wave-length transitions. The calculations are not accurate enough to predict whether the increase in absolute energies of the K-level and the top of the Fermi band will be the same to within experimental error; but the concept that this does occur, as discussed above, leads to a straightforward removal of a contradiction to the simple view of electron behaviour on alloying.

These arguments hold both for the emission and absorption spectra in alloys. In the former case, as Friedel has already discussed[5], the positive hole in the K-shell will be screened by a redistribution of the valence electrons in such a way that the Fermi-level remains constant. In this way Friedel accounts for the emission and absorption edges occurring at the same wave-length. Nevertheless, the effect described in this communication will still hold good whatever the details of the valence electron distribution.

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Effect of Pressure on the Dielectric Constant of Vitreous Silica

SINCE there are, to our knowledge, no reported observations of the effect of pressure on the dielectric constant of any solid, the data that we have obtained on this effect in vitreous silica may be of some interest, even though the precision of our results is low, and vitreous silica is far from being a typical solid.

In the course of calibrating a silica piezometer, we have determined the change with pressure in the capacity of the condenser formed by a silica tube with a silver coating fired on the outside, and filled with mercury extending well beyond the ends of the silver coat. This change is about ten times less than the change in the stray capacity between the silver coat and the metal shield in which the tube was mounted, and was determined by taking the difference of two runs, one with mercury in the tube and one without. The imperfect reproducibility of the stray capacity change has limited the precision of the final results to about ± 5 per cent of the maximum effect. The relative change in the dielectric constant of silica is given by $\dfrac{\Delta \varepsilon}{\varepsilon} = \dfrac{\Delta c}{c} - \dfrac{\Delta l}{l}$; for this computation we have used weighted means of published figures for the compressibility of silica. Fig. 1 shows $\Delta \varepsilon / \varepsilon$ to 4,000 kgm./cm.^{2}, at the temperatures $20°$ and $138°$ C. The limits of error are shown by vertical lines through the plotted points. All measurements were made at the frequency 2,500 c.p.s., with a maximum field strength of about 100 V./cm.
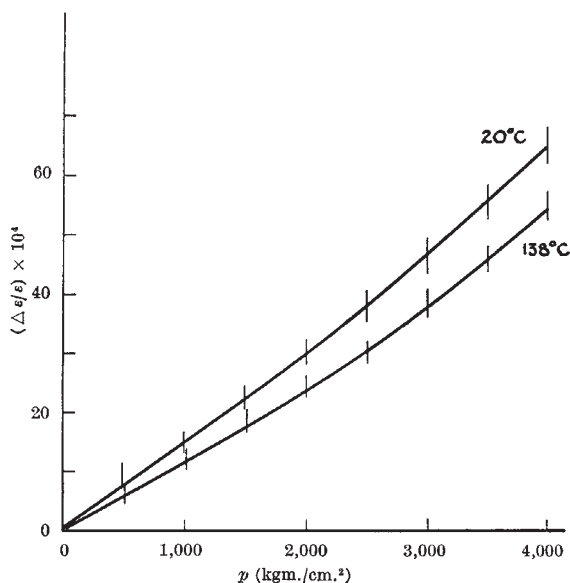

Fig. 1. $\Delta \varepsilon / \varepsilon$ vs. p for vitreous SiO$_2$

Within our limits of error, the molecular polarization $[P]$ of silica, proportional to $\dfrac{\varepsilon - 1}{\varepsilon + 2} \cdot \dfrac{1}{d}$, appears to decrease linearly under pressure, with a slope independent of temperature. The coefficient $\dfrac{1}{[P]} \cdot \dfrac{\delta[P]}{\delta p}$ has the value $-1 \cdot 6 \times 10^{-6}$ per kgm./cm.^{2}, about 3–10 times less than the values found for most of the non-polar liquids that have been studied under pressure.

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