

A simple case of such excitation is the F center in alkali halides, a negative ion vacancy with a trapped electron. The electron jumping from the ground state to the first excited state is responsible for the characteristic color of X-irradiated alkali halides. In the simplest picture this should behave as a particle in the box with $E \sim A_0^{-2}$ (A_0 = lattice constant). Data for a series of alkali halides show that this holds to a fairly good approximation. If one plots the shift of the absorption peak vs relative density (using Bridgman's data) one can then calculate the compressibility of the F center compared with the bulk compressibility. Figure 9^(12, 13) is such a plot for NaCl, NaBr, and KCl. At low pressures the F center is about twice as compressible as the lattice. At high pressure the compressibility approaches that of the lattice. These results are quite compatible with the picture of the F center.

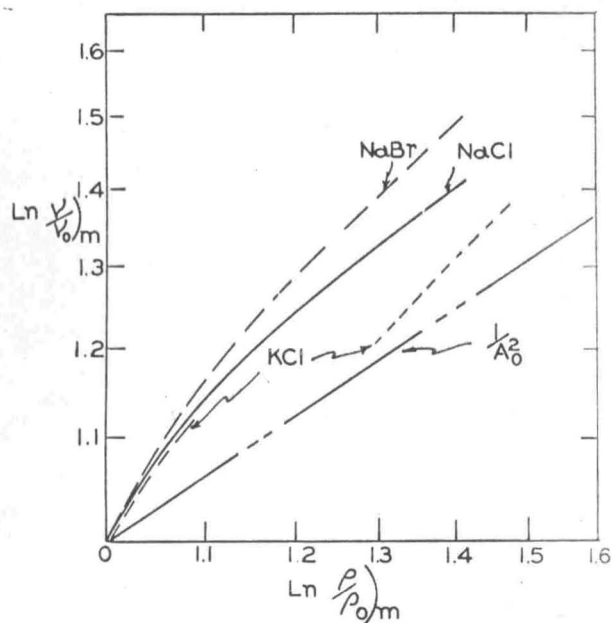


Fig. 9 Color centers in alkali halides.

An important class of phosphors involves a heavy metal ion dissolved in an alkali halide. Examples are Tl^{+} and, more rarely, Pb^{++} . There have been a number of indications that these ions interact quite differently with their environment. Figures 10 and 11^(14, 15) show the initial shift of the absorption peak with pressure for Tl^{+} and Pb^{++} . For Tl^{+} the shift depends strongly on the type of lattice involved, and only slightly on the halide. Pb^{++} depends strongly on the halide and only incidentally on the lattice. These results help to confirm the picture that the excitation is rather definitely isolated on the Tl^{+} ion in the first case, but that the Pb^{++} ion is strongly complexed with the neighboring halides. Incidentally, at high pressures (over 80,000 atm) both phosphors show a definite shift to lower energy with increasing pressure. This would indicate that in all cases the excited state has a flatter curve with interatomic distance in the region of repulsion than does the ground state.

It might be mentioned in passing that it is quite possible with our apparatus to measure decay rates of phosphors as a function of pressure⁽¹⁶⁾ although no data will be presented here.

An important and interesting class of optical phenomena concerns complexes or crystals involving transition metal ions. These ions are characterized by having a partially filled d shell. In the free ion the d levels are degenerate. In the field of the surrounding ions or molecules the d levels are split into two or more groups of levels