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Effect of Pressure on the Optical Properties of Organic Phosphors*

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The effect of pressure to 54 kbar has been measured on absorption spectra, emission spectra, and decay rates of four organic phosphors. For fluorescein and dichlorofluorescein the decay rate increases with increasing pressure. The emission spectrum consists of two peaks which approach each other at high pressure. Thus there appears to be an increased mixing of triplet and excited singlet states at high pressure.

For acridine yellow and orange the absorption spectrum shows a dimer and monomer peak. The dimer peak decreases rapidly in intensity with increasing pressure. At high concentrations the component decay rates are largely independent of pressure. At lower concentrations the decay rate becomes slower at higher pressure. Evidently the emission can be associated with the dimer.

THE effect of pressure to 54 kbars has been measured on the absorption spectra, emission spectra, and decay rates of four organic phosphors. These include fluorescein, dichlorofluorescein, acridine orange, and acridine yellow. The formulas are shown in Fig. 1. The fluorescein and dichlorofluorescein were cp from Eastman Organic Chemicals Company. The acridine orange and acridine yellow were Matheson Coleman and Bell pure grade. The compounds were dissolved in boric acid glass.

The apparatus for absorption spectra studies has been previously described¹ as has the equipment for phosphor decay measurements.² The emission peaks were measured using a Steinheil Munchen spectrograph model 5063 with Royal X Pan film and the equipment arrangement used for decay studies. A Knorr-Albers micro-

photometer connected to a Speedomax recorder was used to measure film density.

Since the windows of the bomb subtend only a small solid angle for light emitted in the bomb, the emission spectra took from 30 min to 6 hr to give measurable density at any one pressure.

One point of interest can be noted from all the data. The runs were never quite reversible, indicating a permanent change in the structure of the boric acid matrix. This effect was not large enough to affect the interpretation of results.

Two energy diagrams which have application to many organic phosphors are presented in Fig. 2. The diagram in Fig. 2(a) was presented by Lewis^{3,4} for fluorescein, and the diagram in Fig. 2(b) is a simplified energy vs configurational coordinate diagram of Fig. 2(a). It illustrates one additional necessary condition for phos-

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