Fluorescence Properties of Europium-trisbenzoylacetonate in a Chloroform Solution

By Takeshi MATSUO

(Received May 13, 1965)

There has been much interest in the fluorescence properties of europium chelates from the standpoint of the use of these compounds as laser devices.[1-3] However, it is very difficult to obtain a laser action by using these compounds in the form of a liquid or a fluid solution, because such organic laser materials as europium-trisbenzoylacetonate (EuB_3) have poor spectroscopic properties in organic solvents; in such cases the half-width of their fluorescence line becomes broader, the intensity of the fluorsesecence line becomes weaker, and the fluorescence decay time becomes shorter than the corresponding values of EuB_3 in the crystalline state.

Recently we found that the fluorescence decay time of EuB_3 in a chloroform solution was about twice as strong, and its fluorescence intensity stronger than those of EuB_3 in a methanol solution.

The chelate compound used here was prepared by adding an equivalent base and then an alcohol solution of $EuCl_3 \cdot 6H_2O$ to a solution of the benzoylacetone. The white-yellow precipitation was collected with suction, washed several times with alcohol, and then dried under 1 mmHg pressure for 20 hr. Found: C, 57.40; H, 4.16. Calcd. C, 56.60; H, 4.25%. The measurement of the fluorescence decay time constant was performed as follows. A xenon flash lamp with a 10 μ sec. pulse duration was used to excite the sample, and the decay curve was recorded with an oscilloscope. The spectral properties of the fluorescence of the EuB_3 solid and of the solutions were

TABLE I. OBSERVED FLUORESCENCE PROPERTIES OF EuB_3 IN VARIOUS STATES

Matrix or state	Decay time in μsec. at 300°K	Spectral region in mμ	Relative fluorescent intensity	Half-value width Å
Chloroform	314±10	total*	strong	44
Methanol	164±10	total	moderate	60
PMMA	250±10	total	strong	65
Microcrystalline	440±10	613	strong	20

* Measured spectral region for the decay time constant.

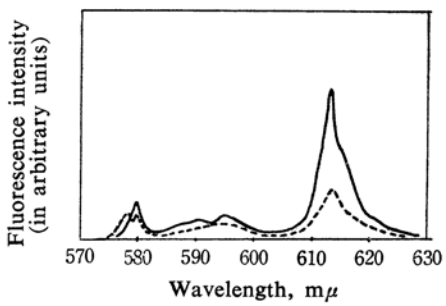

Fig. 1. Fluorescence spectra of EuB_3 at 300°K in chloroform solution (perfect line) and in methanol solution (dotted line)

1) A. Lempicki and H. Samelson, *Phys. Letters*, **4**, 133 (1963).
2) E. J. Schimitscek, *Appl. Phys. Letters*, **3**, 117 (1963).
3) A. Lempicki, H. Samelson and C. Brecher, *J. Chem. Phys.*, **41**, 1214 (1964).

measured with a Cary model 14 spectrophotometer.

The observed spectroscopic properties of EuB_3 in a chloroform solution are, in Table I and Fig. 1, compared with those of various other matrices.

It is highly probable, judging from the results of the investigation of these spectroscopic properties, that chloroform interacts with EuB_3, perhaps through something like hydrogen bonding, and that the co-ordinated Eu^{3+} ion in the complex is protected from external perturbation.

The details of this study will be reported in a later paper.

Department of Chemistry
Central Research Laboratory
Tokyo Shibaura Electric Co., Ltd.
Kawasaki-shi, Kanagawa