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A METHOD OF MEASURING EMISSION SPECTRA FROM THERMOLUMINESCENT MATERIALS*

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It is always difficult to measure the emission spectrum of a thermoluminescent material, because the emission is transient, of low intensity, and the spectrum may change from one glow curve to another. Methods used in the past have involved making extremely fast spectral scans[1], or heating multiple samples and recording a single wavelength band for each sample.[2] The second method is very time consuming and both methods are limited in resolution. This note describes a method which is applicable to at least some materials.

The experimental arrangement was as shown in Figure 1. The monochromator was a 50 cm McPherson. For our investigation we chose LiF (Harshaw TLD-700) in the form of a powder seived to 100-200 mesh. The LiF was placed in the hopper (A) and allowed to flow through the sloping tubing past the monochromator entrance window. The nichrome wire wrapped around the tubing was heated by passing ac current from a variable transformer through it. The vibrator (B), which touches the tubing and assists in obtaining uniform flow, is a vibrator type engraving tool. The LiF emits light as it passes the entrance window and the spectrum can be scanned at any desired speed consistent with the flow rate and capacity of the hopper. Not shown is a light tight box to prevent room light entering the entrance window. The vibrator generates considerable electrical noise and it was necessary to wrap it in a grounded aluminum foil. It is vital that the flow be uniform for this method to work. Flow is governed by the diameter and slope of the tubing and the amplitude and coupling of the vibrator. We found that a slow but heavy flow gives best results. The uniformity of the flow can be checked by stopping the monochromator drive and observing the steadiness of the resulting trace. The

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temperature variations along the glass tubing can be adjusted by spacing the turns of nichrome wire as desired. Some error was perhaps introduced in our experiment due to the use of glass rather than quartz tubing in the wavelength region between 3000 and 4000 Å.

In Figure 2 is shown the emission spectrum we obtained for LiF. The results have been corrected for photomultiplier wavelength response. The results are similar to those obtained by Pearson and Cameron.[2]

It should be noted that it is possible to tell which portion of the glow curve is being read out by plotting glow curves of the material before and after the spectral measurements.

REFERENCES

1. Ghosh, A. K. and B. C. Dutta, "Thermoluminescence Spectra of Lithium Fluoride," Indian Journal of Physics 32, 47 (1958).

2. Pearson, D. and J. R. Cameron, "Emission Spectra of Sensitized and Unsensitized LiF; TLD-100," C00-1105-123 (1966).

FIGURE CAPTIONS

Figure 1--Arrangement of Phosphor Heating Equipment.

Figure 2--Emission Spectrum of TLD-700.

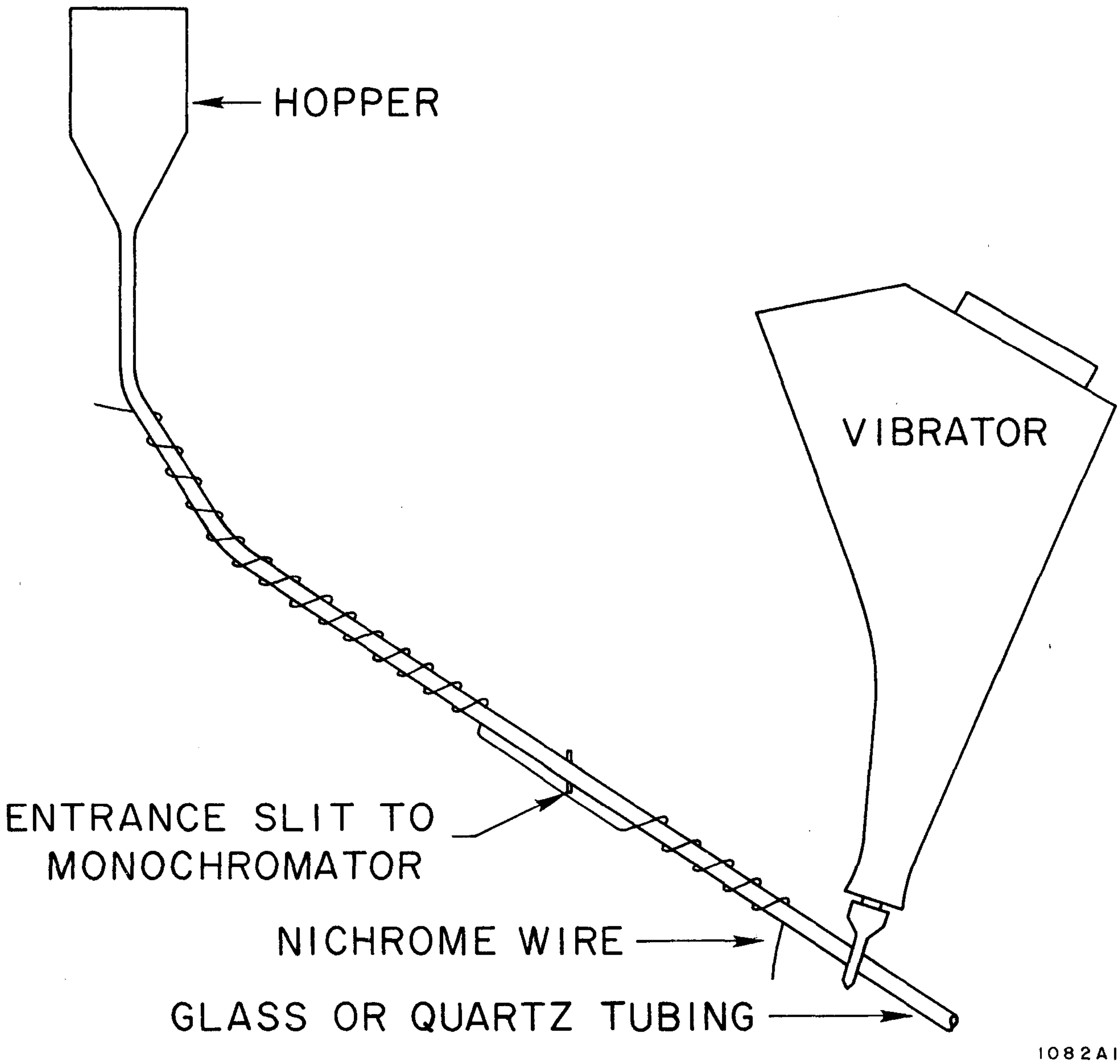
HOPPER
VIBRATOR
ENTRANCE SLIT TO MONOCHROMATOR
NICHROME WIRE
GLASS OR QUARTZ TUBING
1082A1

Fig. 1

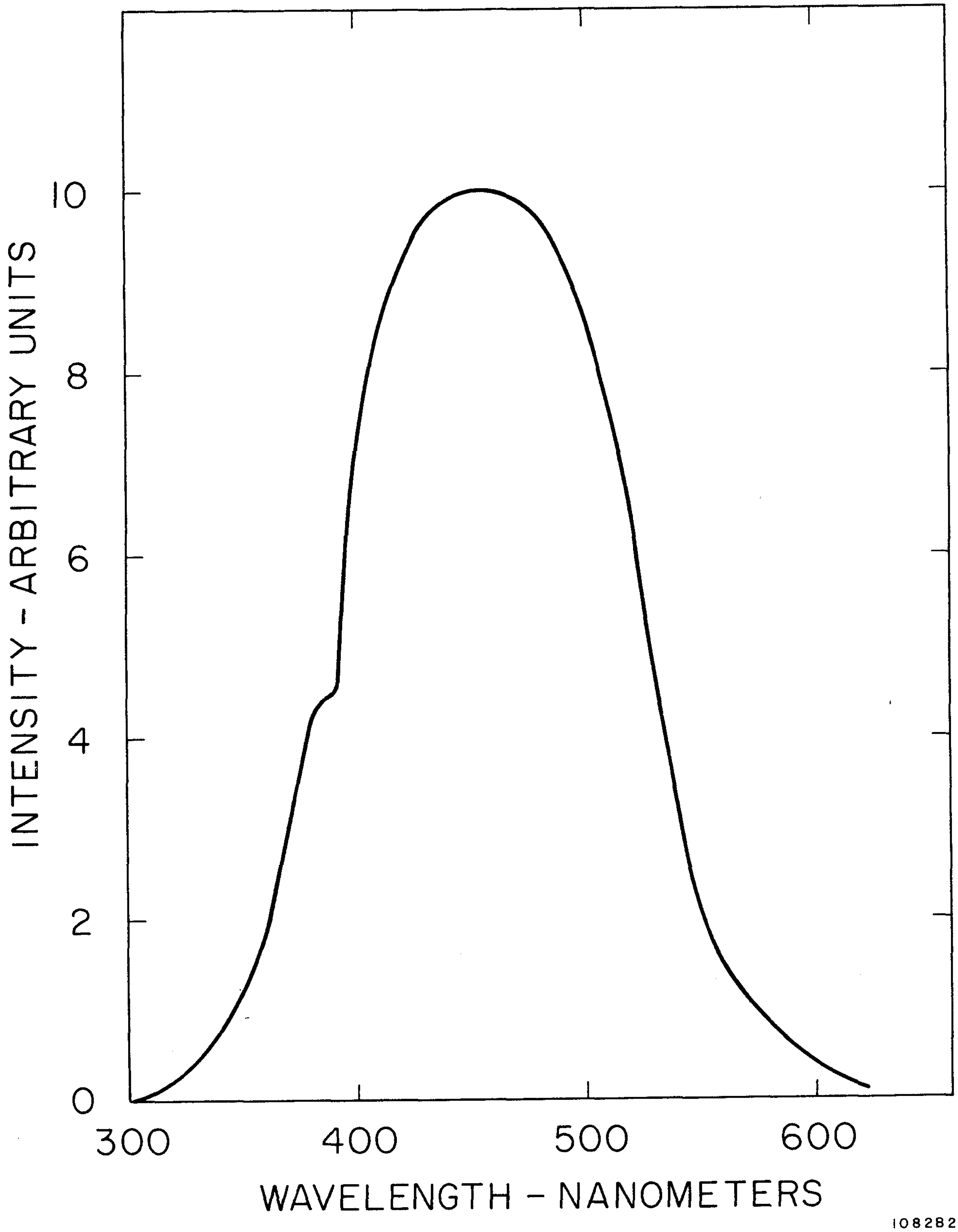
INTENSITY - ARBITRARY UNITS
10
8
6
4
2
0
300
400
500
600
WAVELENGTH - NANOMETERS
108282

Fig. 2