

is recognized. The experimental results are:

1) The color of triboluminescence of ZnS:Mn is orange and is the same as that of the photoluminescence, and we can detect it in the daytime.

2) The phosphors activated with manganese, such as (Zn:Cd)S:Mn, ZnS:Cu:Mn and ZnS:Pb:Mn, are found to emit orange triboluminescence. ZnS:Cu:Mn emits yellow photoluminescence, which consists of both green copper band and orange manganese band, but they emit orange luminescence when they are rubbed mechanically, because the green copper emission is negligibly weak in triboluminescence. ZnS:Pb:Mn is similar to ZnS:Cu:Mn.

3) Triboluminescence of ZnS:Cu or ZnS:Pb is green and the same color as the photoluminescence; the brightness of the triboluminescence is very weak compared with that of manganese-activated sulfides, so we can detect it only in a dark room.

TABLE I

Sample:	Tribo.	Photo.	
ZnS:Mn	orange	s orange	fired at 950°C
ZnS:Mn	orange	s orange	fired at 1200°C
(Zn:Cd)S:Mn	orange	s orange	
ZnS:Cu:Mn	orange	s yellow	
ZnS:Pb:Mn	orange	s yellow	
ZnS:Cu	green	w green	
ZnS:Pb	green	w green	
ZnS:Ag	—	f blue	
(Zn:Cd)S:Ag	green	w green	medium persistence
(Zn:Cd)S:Ag	—	f yellow	

s, strong; w, weak; f, feeble.

Triboluminescence of Zinc Sulfide Phosphors

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It has been known that cubic-ZnS:Mn displays remarkable triboluminescence when lightly ground or agitated in a hard container*.

In the present paper, we will report that almost all zinc sulfide phosphors embedded in the resin produce triboluminescence. The phosphor powder is dispersed in the benzene solution of polymethylmetacrylate, and this viscous and suspended mixture is painted on a plate. When the dry phosphor-resin layer is rubbed with hard materials such as a knife-edge and a needle, triboluminescence

4) ZnS:Ag emits feeble triboluminescence but we can not detect the color.

The characteristics of some phosphors are shown in Table I.

As seen in these results, the zinc sulfide phosphors with manganese activator display remarkable triboluminescence, but the other sulfides produce very weak triboluminescence. The influence of polymethylmetacrylate on triboluminescence has not been studied, but it seems that there is no important mutual action between the phosphor and the resin, for the manganese-activated sulfides are found to emit triboluminescence by the previous grind-method.

* H. W. Leverenz, "An Introduction to Luminescence of Solids" John Wiley & Sons, New York, (1950) p. 171.