Improved Electroluminescent Powder Systems

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Abstract

Large area electroluminescent displays can be driven under AC and DC conditions.

Alternating current electroluminescent ZnS powder technology (ACELP) is one of the oldest display technologies known. Such devices have been used for fixed legends and back lights since the 1950s.

Although improvements in the maintenance have been obtained by coating the phosphor with oxides, the actual synthetic methods used for the phosphor preparation have remained largely the same for half a century. The phosphors used commercially have a large particle size – 25-50μm. Depending on the particular application, the EL cells use ceramic or polymer binders, the latter being the preferred application. The binders are often substituted polyfluorides.

DCEL powder technology was developed in the 1960s and 70s and has been abandoned due to relatively poor maintenance. It was known, however, that under constant power drive conditions, these devices had very good maintenance. However, constant drive circuits were not considered practical.

We have recently started a systematic study to re-examine EL powder technology and our preliminary results are reported here. We have developed a range of synthetic methods for the preparation of phosphor zinc sulphide with controlled particle size and impurity content (1-3). We have also synthesised a new range of binders based on cross-linking linseed oil with sol-gel precursors such as metal alkoxides (4). We can report the following:

- Using the improved phosphors, improved packing of the phosphor into the dielectric binder removes both large volume of interparticle space (see fig. 1) and the need for back layers to remove short circuits.
- A range of dielectric properties can be obtained using different metal oxides and improved results were obtained using boron oxide substituents (see fig. 2). These results can be compared with standard commercially available binders (see fig. 3).
- Thin EL cells using a minimum of two-and-a-half particle layers still result in stable EL structures.
- Constant power circuits are now available yielding good maintenance with DCEL devices.

We have also observed that there is a direct relationship between the particle size and maintenance, the finer particles showing greater deterioration. However, it should be noted that no coating of the phosphors has yet been attempted.

Perhaps it is important to stress that we estimate that by using the newer technologies, EL cells could be produced at less than 10% their present commercial costs.

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2. P.J. Marsh, D.A. Davies, J. Silver, D.W. Smith, R. Withnall and A. Vecht, *J. Electrochem. Soc.*, 2001, **148**, D89-D93
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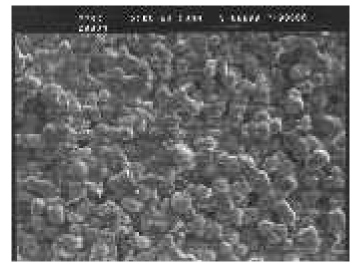

Figure 1. SEM image of Linseed oil based binder / phosphor layer.

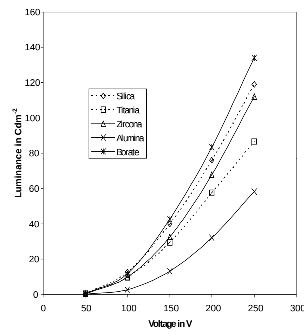

Figure 2. Effect of metal alkoxide on linseed oil based binders.

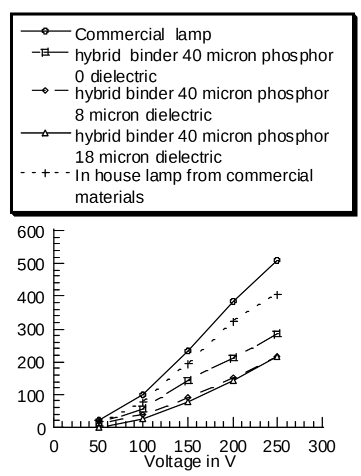

Figure 3. Comparison of linseed oil based and commercial binders.