SunTronic Electroluminescent Materials

Application Guide

This document is a complementary resource to the SunTronic Materials for Electroluminescent Lighting (EL) product brochure. It serves as an informative guide about principles of EL Light operation, construction, performance and manufacturing. Process optimization is essential in order to meet the requirements for specific designs of the EL lamp and processing equipment used. These guidelines may not be applicable for new design or manufacturing concepts or new end-use applications, and the user must evaluate applicability of this document on a case-by-case basis.

Printed EL panels feature low heat generation, low power consumption, long operating life and high resistance to impact and vibration, which makes them suitable for even the most demanding applications.

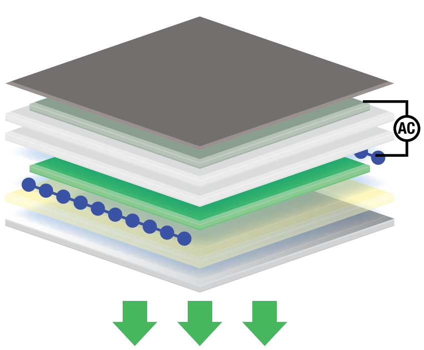
EL Panel Construction

EL panels are multilayer constructions consisting of a carrier substrate, transparent electrode, dielectric, phosphor and back electrode layers. Examples of standard and reverse construction are shown below. In the standard construction, the substrate must be transparent to allow the emission of light. Printing silver bus bars close to the area that is to be lit improves light uniformity by minimizing voltage drop across the transparent electrode surface. This is especially important when using non-ITO electrodes. The thickness of each design layer is crucial to the performance of EL lamps. Therefore, thickness must be monitored and maintained. In both standard and reverse construction, it is highly recommended to print two layers of dielectric for better reliability of operation. When the EL lamp is designed for outdoor use, supplementary protection against UV and moisture is essential. Once the final product has been made, a protective lamination or a protective screen-printed layer should be used.

Most of the layers can be screen-printed using Polymer Thick Film inks. The SunTronic EL materials package includes thermally curable phosphor, dielectric and conductive pastes. Printing and curing specifications are given in individual product data sheets, which can be requested from Sun Chemical representatives or online at https://www.sunchemical.com/contact-us/. The inks are mutually compatible and provide excellent flexibility, reliability and adhesion to ITO (indium tin oxide) or other transparent electrodes used in EL lighting. Substrates can be flexible or rigid and depending on the type of the construction design, they may need to be transparent.

Standard Build

Encapsulant
Back electrode
Dielectric layers 1 & 2
Phosphor layer & bus bar
Front transparent electrode
Transparent substrate

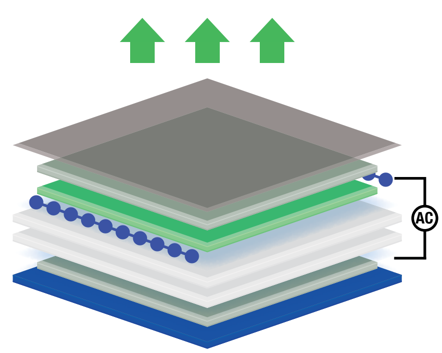


Emission of light

Reverse Build

Emission of light

Transparent encapsulant
Transparent electrode
Phosphor layer & bus bar
Dielectric layers 1 & 2
Back electrode
Substrate



EL Panel Operation Basics

EL lamps are essentially parallel-plate capacitor devices. EL phosphor is embedded in the construction comprising a dielectric and two parallel electrode plates, one of which is transparent. Application of AC voltage to the conductive plates induces an alternating electric field, due to which there is a rapid charge and discharge of the phosphor layer. Each charge-discharge cycle results in light emission. EL lamps typically use an inverter (a converter from low voltage DC to higher voltage AC power) as a power source. Since the intensity and number of light pulses depends on the magnitude of applied voltage amplitude and frequency, brightness of an EL lamp can be generally controlled by adjusting frequency and voltage amplitude of the inverter.

Operating voltage can range from 60-250V. However, for most electroluminescent applications, typical AC RMS (root mean square) voltage is 100-120V. Within the operating range, the light intensity/brightness has a proportional link to voltage. For example, to achieve an approximate quadrupling of the brightness of an EL lamp, RMS voltage needs to be doubled.

Operating frequency can range from 50-5000 Hz, but most applications use 400-800 Hz. A clean sinusoidal wave is preferred, because square wave profiles usually contain harmonics which can shorten the life of the lamp. Increasing the frequency will increase the brightness of the lamp and change the color to some degree.

For automotive applications, where low light and long lifetime is needed, a voltage of 100V with a frequency of 400Hz is most common.

In the advertising industry, where brighter light and relatively short lifetime is required, a voltage of 137V with a frequency of 800Hz is used.

Voltage and frequency affect the life of the lamp; therefore, designers must select a power source with appropriate balance between achievable intensity and expected working life of the EL lamp for a given end use. The operating life of EL lamps is dependent on multiple factors and can range from a 2,000 to 50,000 hours. Lifetime requirements are dependent on the end use applications and the longevity of the given product.

SunTronic phosphor pastes contain encapsulated phosphor powders, typically made from zinc sulphide. The phosphor powders are designed and functionalized to emit light at specific wavelengths when under electro-magnetic field, producing different illuminating colors.

The application working life of EL lamps refers to the duration it takes for a lamp to decline to an unacceptable level of function for its intended application. This concept differs from half-life, which represents the time it takes for the lamp's brightness to decrease by half. In contrast, the application working life typically concludes after a relatively minor reduction in brightness.

Luminosity of the phosphor particles and therefore the light output of the EL lamps will gradually decrease with the time in operation. Different colors of EL phosphors will have different decay patterns. Lamps with initially higher levels of brightness show a steeper intensity decay curve than those with lower initial brightness levels. Turning an EL lamp on and off has no adverse effects on the lamp lifetime. The presence of moisture will accelerate light intensity decline, and so requires good encapsulation.

Inverters which are load-responsive can increase the usefulness of an EL lamp. Changes in the load as the EL lamp ages cause the inverter's voltage and frequency output to rise, thus maintaining the lamp's brightness.

For further assistance or to request product information, please contact us via Contact Us - Sun Chemical. We look forward to supporting your innovative applications and helping you bring your projects to life.

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