AGING ANALYSIS ON ORGANIC LIGHTING DIODE (OLED) PRODUCTION FOR PASSIVE MATRIX SCREENS

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Abstract - With the development of technology in recent years, the working areas of organic electronic materials have expanded considerably. It is preferable to show different properties of organic molecules when they are functional. Some of these devices are organic light emitting diodes (OLED), organic solar cells, electrochromic devices and capacitors. These devices include OLED and organic solar cells. OLEDs have been developed for over 20 years and are used in mobile phones and televisions.

This paper presents aging analyzes which were used to determine the size of deformations observed in OLED productions. In this regard, the techniques of applying voltage on the infrared and lumens were analyzed on different character OLED circuits.

Keywords - OLED, Lifetime, Aging Analysis.

I. INTRODUCTION

Measurement of current-voltage and luminance is a popular method for OLED characterization. The conclusion about the OLED breakdown can be taken by collecting these data over moment. Long lifetimes are necessary for the business use of the OLED technology (Howard and Prache, 2001). Burn-in impacts are of excellent significance in relation to OLEDs that are used in screen apps. 3% percent light gap between neighboring pixels, the burn-in impact can be noticeable and can result from degrading impacts (Schaer et al., 2001).

The lifetime of the OLEDs must be raised to around 60,000 hours in order to solve this burn-in impact. To validate these long lives experimentally, the aging of the OLED is ineffective. Extrapolation techniques and ways to accelerate the degradation process are therefore used. Higher flows and high temperatures are prevalent ways of enhancing aging. Furthermore, correct fitting and extrapolation can contribute to smaller measuring moments (Sekitani, 2005). This paper discusses the analyzing techniques for correctly interpreting this information and the method of inner degradation and measuring aging levels on OLEDs relevantly (Fry et al, 2005). By analyzing various degradation measures with distinct kinds of OLED, Meerheim et al.(2006) examined this relations based on mathematical equations in detail.

It has been discovered that approximations of only degradation information lead to alignment. Distinct methods, which is described below, is used to obtain more accurate information within the same aging period. The method of determination can be accelerated by using various present densities for old specimens of the same OLED sort.

II. PROCESSING ON OLEDs

The OLED specimens used during this job comprise four separate OLEDs called pixels. Its construct is described by both the ITO and the cover used during the evaporation of organic material and cathode. Depending on the layer of the cathode cover, the picture region varies from six to seven square millimeters. Two distinct deposition tolls, one and one void processing instrument are used for evaporation. Depending on the deposition instrument used, the surface size, sample drying and test handling vary.

In order to avoid the contamination on the surface of the substrate, the substratum requires to be washed before it is removed. Failure to clean the substrates would result in brief circuits or less efficiency. All substrates are pounded with separate solvents in ultrasound pools. The precise method varies according to the deposition instrument used, and the following paragraphs will be clarified.

The specimens are embedded in the nitrogen environment after the test preparation to ensure that responses with oxygen and water are not allowed. This is achieved by a tiny glass deck that covers the active region. The bottle is screened for UFO II specimens with an epoxy resin with two components and Lesker UV hardening foam. When a bottom-emitting OLED has no light, a spray can therefore be added that is able to bind water vapor within the encapsulation glass. The specimens can be processed and analyzed in the atmosphere after this phase.

III. OLED LIFETIME MEASUREMENTS

A lifetime measuring configuration constructed by Novaled AG (Current-Voltage-Luminance, IVL) was used to track the aging of an OLED during electric vehicles over a longer period. The lifetime

configuration comprises of 64 units as shown in the Figure 1(b). A single OLED sample consisting of four pixels can be driven and measured each measuring device. The cabinet comprises a sample holder component and an optical sensor device with electrical connections. The test cathode is linked to the earth. The four-pixel anodes are individually linked so that each pixel can be powered by a fixed steady stream or tension as well as by an alternative stream. The current density in most cases is between 10 mA/cm^2 and 60 mA/cm^2. In the aging method always takes place under a steady current. The configuration is restricted to voltages up to 15 V. Figures on diodes for radiation in the red, yellow and blue portions of the atomic range are used to detect excited light. Changes can thus be identified in the colorimetric CIE significance of the emissions lights.

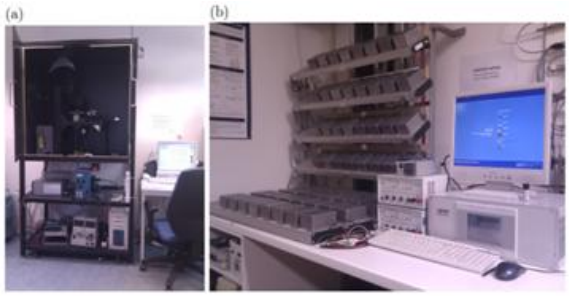

Figure 1: (a) Picture of the IVL-measurement setup from the company Novaled AG. (b) Picture of the OLED lifetime setup.

Three image diodes are used to identify heated light in the red, yellow and blue nuclear areas for radiation. The setup is limited to voltages up to 15 V. The colorimetric CIE importance of emission lamps may therefore be recognized as the changes. It is not possible to draw an OLED with a scope.

The Michelson interferometer is the central component of an FTIR spectrometer. In most instances, an interferometer with a classic two Michelson beam is used. The IR source typically is a globar, a carbide rod of silicone. The globar is electrically heated at temperatures of 1000 to 1650°C and has a black body heater spectrum. The sensor is typically a germinated sulfate of triglycine (DTGS) or a cadmium telluride mercury (MCT) detector. DTGS, which is commonly used for conventional applications, comprises of a sulphate glass deuterium triglycin and two electrodes, for instance an alkaline halide window, contained within a temperature resisting encapsulation. The pyroelectric impact is used in the DTGS sensor. This increase results in a convolution in the right range and a Fourier transformation of the boxcar feature. the range now acquired comprises. This impact must be taken into account when analyzing FTIR information.

IV. MEASUREMENT RESULTS

Lifetime experiments of the OLEDs was identified with electrical characterization. Devices named 1 to 4 are aged at an existing density of 60mA/cm^2, the original light being about 4100 cd/m^2. In Figure 2. all of degraded systems have clear variations with among appliances. Device 1 not exposed to gas indicates a significantly longer within have a half-life period of 1,037 hours relative with exposed gas appliances. Similar degradation conduct exhibits in Device 2 and Device 3. Device 2 has a half-life of 141.2 hours and Device 3's half-life of 140.5 hours.

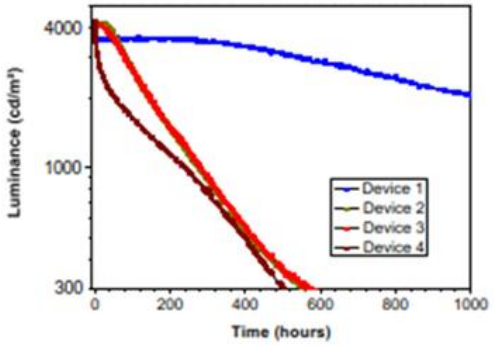

Figure 2. Luminance decay of the four devices during electrical stress. The devices were aged at a current density of 60mA/cm^2.

The features of the current voltage luminance, as well as the internal OLED quantum efficiencies, are examined on Figure 3 & Figure 4. Figure 3 illustrates the luminance and present reliance on the working power of the six OLEDs. During voltage is applied in opposite directions, OLED B and OLED F have a smaller leaking current.

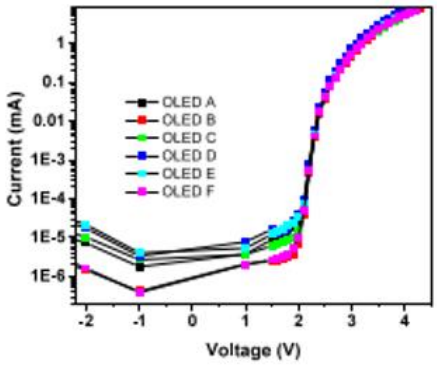

Figure 3: Plot of the current-voltage characteristic of the six OLEDs.

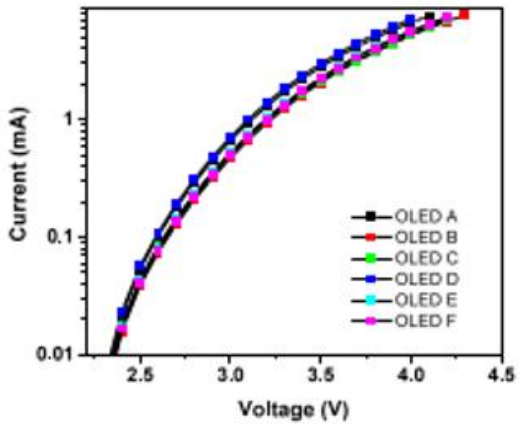

Figure 4: Detailed plot of the current-voltage dependence between 2.25 and 4.5 V.

Furthermore, OLED A and OLED D display greater temperatures for a certain voltage, as shown in Figure 5a and b. This shows that OLED A and OLED D have a reduced strength than other OLEDs.

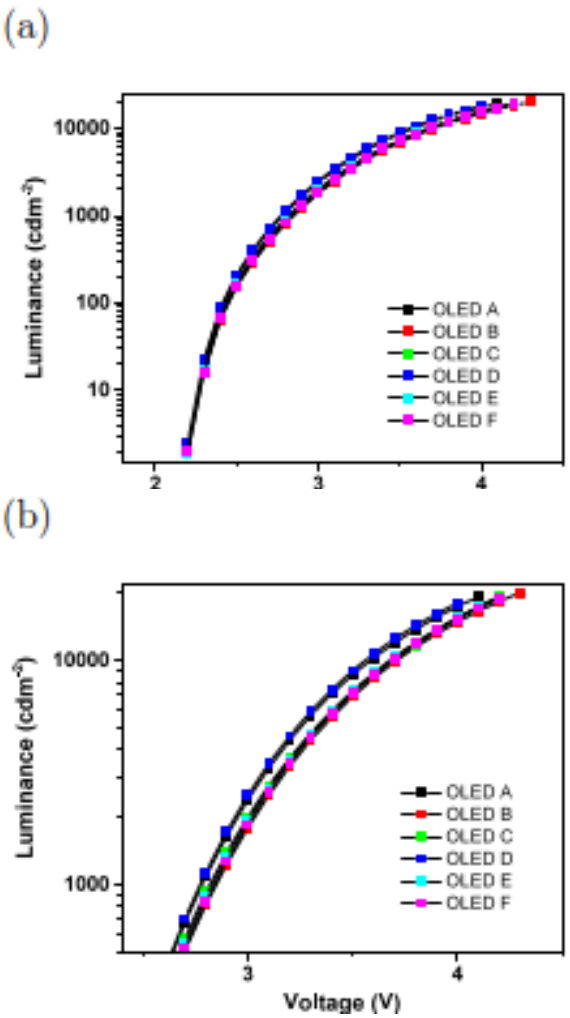

Figure 5: (a) Plot of the luminance-voltage characteristic of the six OLEDs. (b) Detailed plot of the luminance-voltage dependence between 2.4 and 4.5 V.

The light deterioration is shown in the figure under a steady current. In Figure 6a and b, length of half-life of OLED A and OLED D is longer, and OLED E and OLED F are smaller than other OLEDs. The image is not entirely congruent if the half-life of the OLED is contrasted with the material cleansing performance of the α-NPD fabric used. The longest life OLED A containing α-NPD, three times sublimated in a void sublimation scheme tube-based, displays OLED F which includes the shorter lifetime α-NPD. This corresponds to the requirements. On the other hand, OLED E shows a lower lifetime performance compared to OLED D even if OLED E contains α-NPD sublimated in a tube-based vacuum sublimation system twice than OLED D sublimated just once in a tube-based vacuum sublimation system. This incongruity shows that the quality of the α-NPD does not only affect the life of the OLED.

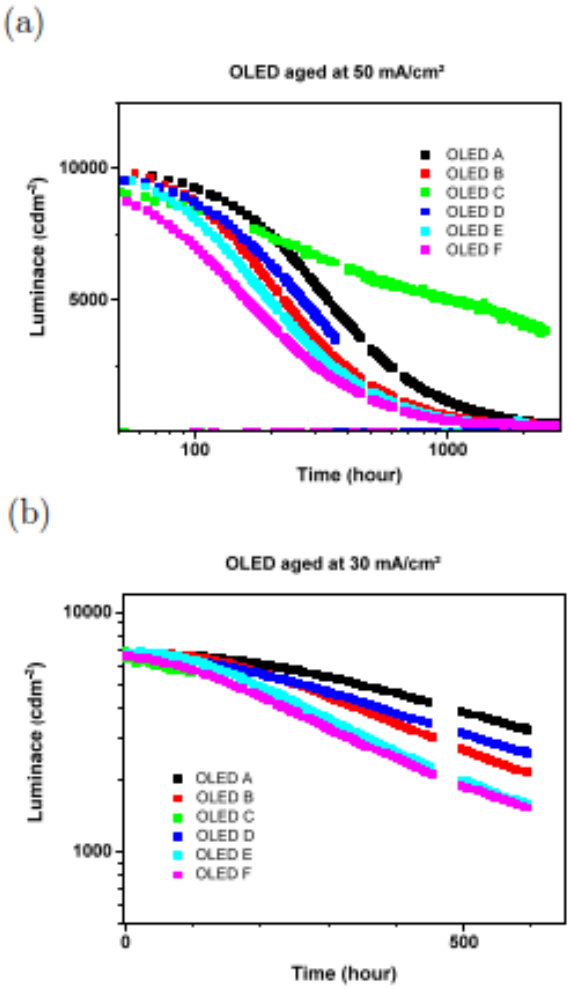

Figure 6: (a) Plot of the relative luminance decay over time. The aging was conducted under a constant current of 50mA/cm^2. (b) Plot of the relative luminance decay with a driving current of 30 mA.

CONCLUSION

The fact that organic materials used in various areas with the development of technology results with organic light emitting diodes (OLEDs) become more popular nowadays. Since OLEDs still have some development processes, weaknesses of OLEDs are needed to be determined by aging analysis. Both IVL and IR measurements provides to make OLED aging analysis that can clearly show current-voltage and luminance distinctions between OLEDs with different characters. OLED industry may get the benefit of the previously shown experimental results for longer lifetime, having more reliable and robust designs.

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