Chemistry

2C/2002G026

Soft X-ray Emission Spectroscopy of organic electro-luminescence materials.

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Introduction

Organic electro-luminescence materials attracts attention as a material new in recent years for flat panel display and the utilization is progressing quickly. As for the organic electro luminescence device, luminescence with a single layer (thin single film) was tried at the beginning.

However, what is depended on junction of nano scale thin films of several layers which have a different function, such as carrier injection, transportation, and luminescence, is in use now. The kind of very many organic electro luminescence devices is known.

The organic thin film device that consists of three layers is a typical thing put in practical use. In this system, three materials are CuPC (Copper phthalocyanine) as the injection layer of a positive hole, NPD (Triphenylamine dimmer) as a positive hole transportation layer, and Alq3 (Tris(8-hydroxyquinolinato)-aluminum(III)) as an electronic injection layer. This system looks like PN junction composition. It is supposed that luminescence is happened at the side of AlQ_3 's layer in a NPD junction interface. However, this is reasoning since luminescence wavelength changes with organic doping at the layer of AlQ_3. Moreover, about the electronic state of each layers, it is not known for details without ionization potential measurements and ultraviolet measurements.

In this experiment, soft X-ray luminescence spectrum measurements and soft X ray absorption-spectrum measurements were performed for the electronic state investigation of multilayer film organic electroluminescence material and collecting the basic data of organic electroluminescence material development.

Experiments

Samples

The sample structures are shown as follows.

1. Fresh CuPC 250Å on ITO glass.
2. degraded in air 30min CuPC 250Å on ITO glass.
3. CuPC 250Å + NPD 450Å on ITO
4. CuPC 250Å + NPD 450Å + Alq_3 600Å on ITO

All samples were made at Nippon Steel Chemical Co., Ltd, kitakyushu. The samples were created by the vapor-depositing method.

Result and dissection

Cu target soft X-ray absorption spectra are shown in Fig.2. The difference remarkable in a spectrum of the luminescence was not seen.

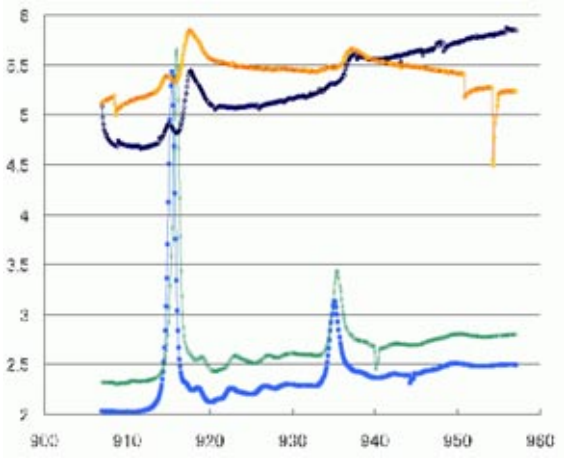

Fig.2 Cu-SXA spectra . ● :only CuPC(degraded on ITO), ●:only CuPC(fresh on ITO),●:CuPC/NPD, ♦CuPC/NPD/Alq3

CuPC degrades with air and the brightness of the luminescence are decreased in the device. However, air degradation did not affect a copper valence and spectrum. On the other hand, a difference of CuPC+NPD and CuPC+NPD+Alq3 spectrum were obtained from the single film CuPC spectrum. This shows that a electronic structure change which includes a valence change by the interface of NPD and CuPC has occurred.

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