

Top Emission Organic EL Devices Having Metal -Doped Cathode Interface Layer

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Abstract

Top emission organic EL devices were fabricated by using metal-doped cathode interface layer to achieve low drive voltages. Also, facing-targets-type sputtering was used to sputter indium-tin oxide layer on top of organic active layer. The devices fabricated in this study showed reasonably high external quantum efficiency of about 1 % which is comparable to that of bottom-emission-type devices.

1. Introduction

Passive-type organic EL devices have been commercialized for cell phones and car stereos, and the active-type full color displays have been demonstrated. In the active-type, there are two types of device structures have been proposed. One is bottom-emission-type and the other is top-emission-type. The top-emission-type device have advantage of larger emitting areas over the bottom-emission-type because driving TFTs can be placed under the emitting pixels in the top-emission-type.

In this paper, we introduce our approach to fabricate efficient top-emission-type devices using the technologies developed in our laboratories.

2. Experimental

The typical device structure for the top-emission-type device is: glass/Al/indium-tin oxide (ITO)/amine derivative (NPD)/aluminum complex (Alq)/Cs-doped phenanthroline derivative (BCP)/ITO, shown in Figure 1. Al and ITO layers were sputtered by using a facing-targets-type sputtering apparatus. NPD and BCP layers were vacuum deposited. Cs doping was carried out using Saes Getter's Cs dispensers.

3. Results and Discussion

We used Al as the anode and ITO as the cathode, respectively. Due to relatively low work function of Al, a thin ITO layer was sputtered on Al cathode. Also, a Cs-doped layer was inserted between cathode ITO and organic layer for the injection of electrons from ITO to Alq layer at low drive voltages.

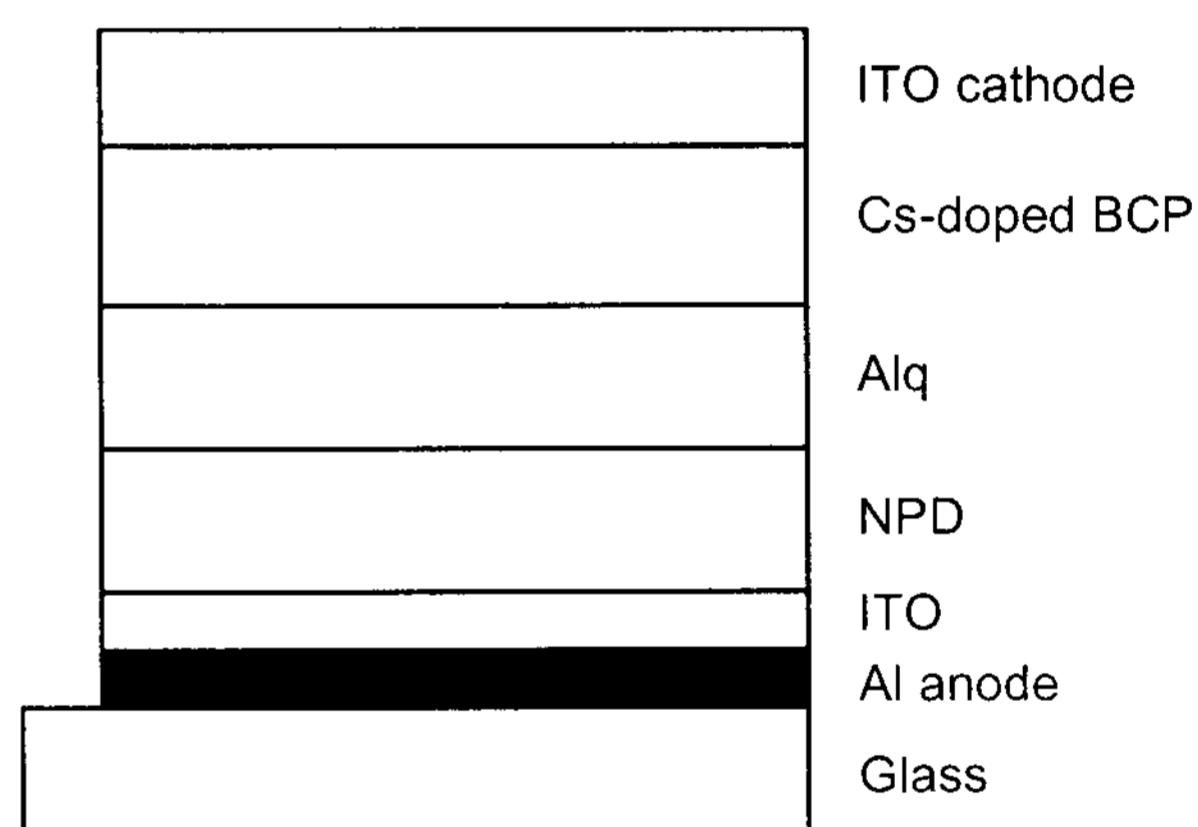


Fig.1 Device structure

Because conventional sputtering method requires very low sputtering rates due to sputtering damage to the organic layers. We therefore employed facing-targets-type sputtering apparatus in which generated Ar plasma is confined between the ITO targets. Relatively high deposition rate of ca. 4 Å/sec was achieved.

Luminance of 2600 cd/m², luminous efficiency of 0.56 lm/W, and an external quantum efficiency of ca.1 % were successfully obtained, which are comparable to those of the conventional bottom emission type devices.