Topics

Organic Electroluminescent Material : Pyrene-Adamantane Derivatives

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An organic electroluminescent (EL) device is a planar light emitting device consisting of a fluorescent organic thin film and a pair of electrodes formed on a glass substrate. The thickness of the organic thin film is between several tens and several hundreds (nm). For even light emission without shorting, a stable laminated structure must be maintained. Pyrene (**Fig. 1**) as the fluorescent material, for example, emits a strong blue fluorescence in a solution but hardly emits in the solid state because it's easy to crystallize. Therefore, a thin film of pyrene cannot be used as a stable organic EL device.

If the pyrene molecule can be fixed in the non-crystalline state, an organic EL device emitting strong, stable fluorescence can be obtained. This report describes an organic EL device with high brilliance and high thermal stability realized by synthesizing a pyrene-adamantane derivative**(1)** in which pyrene is linked with the rigid adamantane molecule (Fig. 1).

The pyrene-adamantane derivative**(1)** was synthesized in four steps from adamantanone. A thin film of **(1)** was formed on a glass substrate by vacuum deposition. The thin film is non-crystalline and no crystallization occurred after the thin film formation. Since two pyrene parts in **(1)** are twisted in position during fixation on the adamantane as shown in Fig. 1, crystallization does not occur. The glass transition temperature of **(1)** is 181°C, and a uniform film can be maintained even at high temperatures.

The organic EL device structure (**Fig. 2**) consists of a transparent electrode (ITO), a hole transporting layer (HTL), an emittinig layer (EML), an electron transporting layer (ETL) and finally an LiF/Al electrode laminated on a glass substrate. The EL device with **(1)** laminated as the light emitting layer emits a blue light. **Fig. 3** shows the luminescence-current characteristics of the EL device. The characteristics of a device in which **(1)** is replaced with Alq_3 (aluminum-quinolinol complex) widely used as a green light emitting material are also shown. The characteristics of these two devices are almost the same, indicating the high luminance of **(1)** as a blue light emitting material.

The pyrene-adamantane derivative is a light emitting material with excellent thermal stability and luminance, and it is expected to be widely applied in blue light emitting devices.

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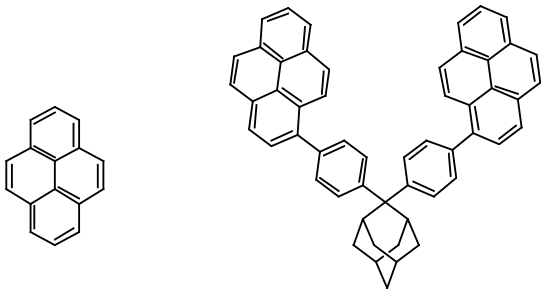

Fig. 1 Structures of Pyrene and Pyrene-Adamantane derivative.

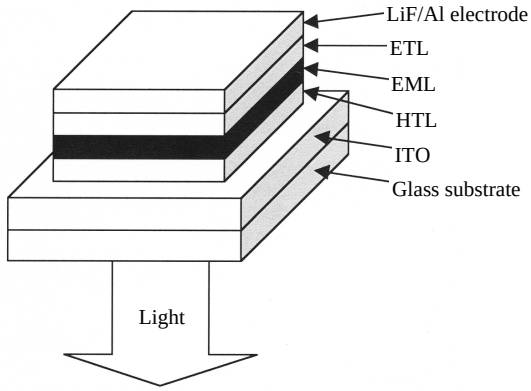

Fig. 2 Structures of EL device.

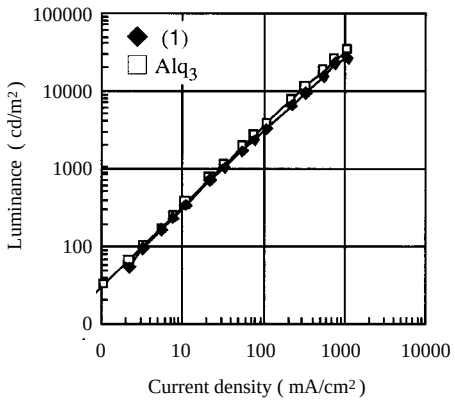

Fig. 3 Luminance-current characteristics.