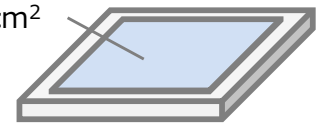
Identification of Dopant Ratio in Organic EL Device

In OLED devices, dopant ratios have a significant effect on luminescence efficiency, color purity, and lifetime. In the case of co-deposition, films are not always deposited at the same ratio as the preparation, depending on the characteristics of the compound. In this report, we present an example of Identification of the dopant ratio in an OLED film with and without standard materials (SMs).

Analysis Samples

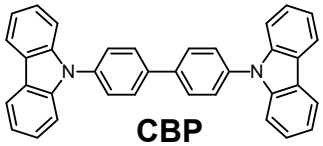
– OLED films –

Thickness: 50 nm
Area: 5 cm^2

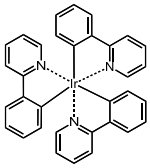


Host : **CBP**
Dopant : **Ir(ppy)$_3$**

–Chemical structure–



CBP
(4,4′-Bis(N-carbazolyl)-1,1′-biphenyl)



Ir(ppy)$_3$
(Tris(2-phenylpyridine)iridium(III))

–Dopant ratio–

Sample	CBP/Ir(ppy)$_3$*1
①	1/0.010
②	1/0.100

*1 Ratio for preparation

⇒ Solvent extraction followed by quantitative analysis (QA) with LC/UV and LC/CAD.

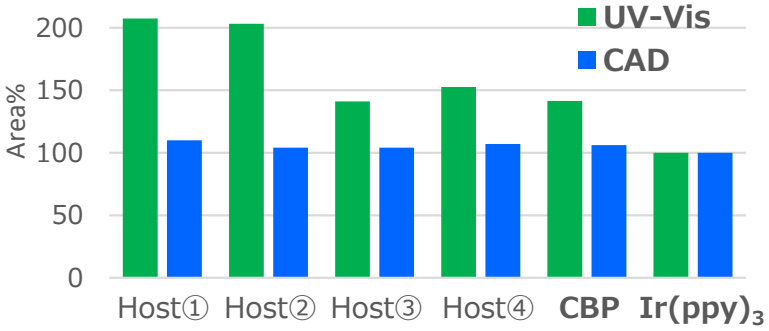
Detector's Features & Sensitivity

● **UV-Vis (PDA)**
・Detection of light-absorbing substances
・Large differences in sensitivity by structure
⇒ **SMs are needed for QA**

● **Charged Aerosol Detector (CAD)**
・Detection of electrically charged compound by corona discharge
・Small differences in sensitivity by structure
⇒ **Quantifiable without SMs**

– Comparison of peak area values in same concentration solution –

※ Normalized with the peak area value of Ir(ppy)$_3$ as 100



UV-Vis: Large variation in peak area values.
CAD: Within 10% variation in peak area value.

Absolute Quantification by LC/UV

1. Preparation of calibration curves for CBP and Ir(ppy)$_3$ using by each standard solution
2. Calculation of quantitative values using each calibration curve

Sample	CBP/Ir(ppy)$_3$
①	1/0.010
②	1/0.149

Quantification using each standard solution clearly showed that sample ② was not deposited at expected dopant ratio.

Semi-quantification by LC/CAD

1. Preparation of calibration curves using standard solution of CBP
2. Calculation of quantitative values using only calibration curve of CBP

Sample	CBP/Ir(ppy)$_3$
①	1/0.010
②	1/0.150

The semi-quantitative value of Ir(ppy)$_3$ using the calibration curve of CBP was less than 1% deviation from the absolute quantitative value.

Dopant ratio and co-deposition ratio of other company's products can be calculated even in absence of standard materials.

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