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Application News

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Spectrophotometric Analysis

Fluorescence Measurement of Organic Electroluminescent Material

Screens, lighting, and other products that incorporate organic electroluminescent (EL) materials are being developed on a daily basis in the electrical and electronic goods sector. Organic EL material development involves the synthesis of new substances and verification of their optical properties using photoluminescence (PL) technique. Researching the PL allows us to find materials that emit light with high efficiency, and we can elucidate the mechanism of its fluorescence in solution. Organic EL materials are developed through this process to meet specific criteria that can include hue, low energy consumption, or high luminous efficiency.
In order to evaluate organic EL materials, fluorescence must be measured quickly and accurately over a wide range of wavelengths.
Introduced here are the measurements of porphyrin solution (solvent: chloroform), an organic EL material, using an RF-6000 spectrofluorophotometer, with the help of the Institute for Basic Science, Pohang University of Science and Technology (POSTECH), South Korea.

Fig. 1 RF-6000 Spectrofluorophotometer

Three-Dimensional (3D) Spectra Measurement

Fig. 1 shows the RF-6000. To first verify which fluorescence wavelength(s) appear at which excitation wavelength(s), the 3D spectra of porphyrin solution were measured using the analytical conditions shown in Table 1.
Fig. 2 shows the 3D spectra obtained, with excitation wavelength (Ex) is shown on the vertical axis, fluorescence wavelength (Em) is shown on the horizontal axis, and fluorescence intensity represented by different colors. The RF-6000 performs spectral correction in real time, allowing for the acquisition of corrected spectra with the factors due to instrument characteristics removed as soon as sample analysis is complete. Intense fluorescence of the analyzed sample was observed at around Em 660 nm and Em 720 nm. This fluorescence appeared at many excitation wavelengths, though results show the strongest fluorescence appeared at Ex 390 nm, followed by Ex 520 nm.

Table 1 Measurement Conditions

Instrument used	: RF-6000
Spectrum Type	: 3D spectrum
Measured Wavelength Range	: Ex 300-600 nm, Em 500-800 nm
Scanning Speed	: 6000 nm/min
Wavelength Interval	: Ex 10.0 nm, Em 2.0 nm
Bandwidth	: Ex 5.0 nm, Em 5.0 nm
Sensitivity	: Low
Measurement Time	: Approximately 2 minutes

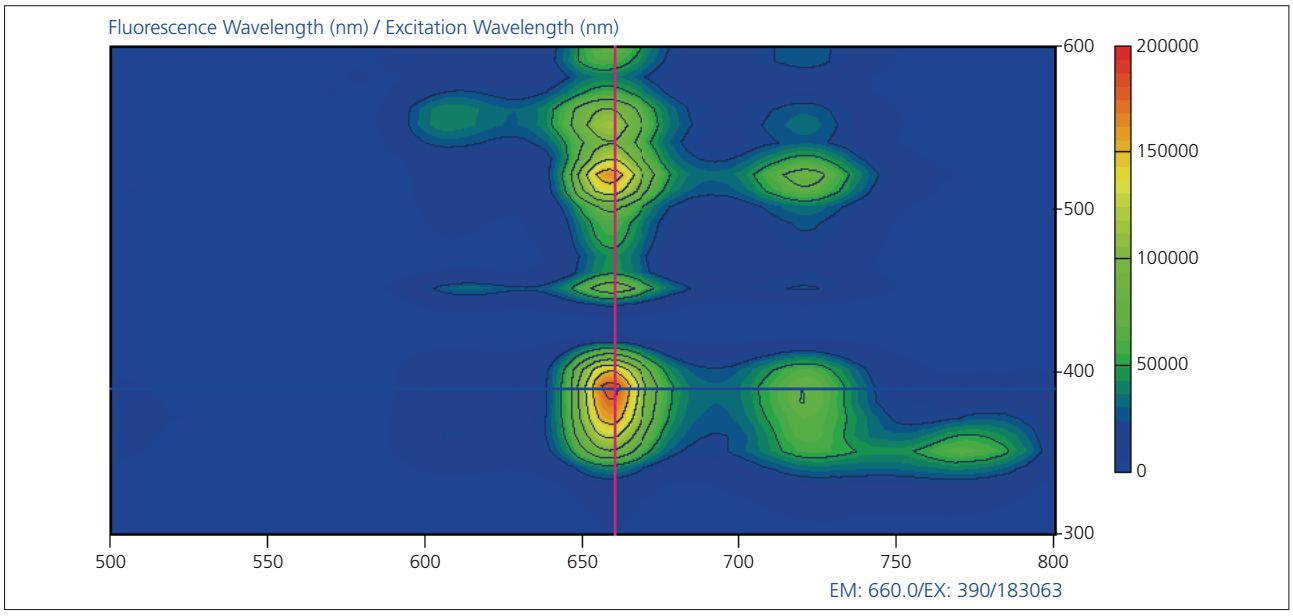

Fig. 2 Three-Dimensional Spectra of Porphyrin

Fluorescence Spectra Measured at Different Excitation Wavelengths

The 3D spectra in Fig. 2 shows fluorescence peaks at multiple excitation wavelengths. To observe fluorescence peaks in more detail, fluorescence spectra measurements were performed using the conditions in Table 2.
Fig. 3 shows fluorescence spectra at various excitation wavelengths, and that fluorescence peaks at 658 nm and 720 nm are present for all excitation wavelengths used. Fig. 3 also shows that the 658 nm fluorescence peak appears strongest at an excitation wavelength of 390 nm, and the 720 nm fluorescence peak appears strongest at an excitation wavelength of 520 nm.

Table 2 Measurement Conditions

Instrument used	: RF-6000
Spectrum Type	: Fluorescence spectrum
Measured Wavelength Range	: 390/420/520 nm for Ex, Ex to 800 nm for Em
Scanning Speed	: 200 nm/min
Wavelength Interval	: 1.0 nm
Bandwidth	: Ex 5.0 nm, Em 5.0 nm
Sensitivity	: Low

Conclusion

As the development of various organic EL materials continues, there will be a demand for spectra of higher sensitivity over a broader wavelength range to use in organic EL material evaluation. The RF-6000 is able to acquire 3D spectra quickly and accurately, and simultaneously acquire spectra with high sensitivity up to 900 nm. Using an optional integrating sphere with the RF-6000 also allows the measurement of quantum efficiency (absolute quantum yield).
In this study, using the RF-6000 spectrofluorophotometer, we successfully verified the 3D spectra and fluorescence spectra of an organic EL material.

<Acknowledgments>
The sample used in these measurements was provided by Professor Kyeng Park, the Institute for Basic Science, Pohang University of Science and Technology, South Korea. We are sincerely grateful to Professor Park for his help.

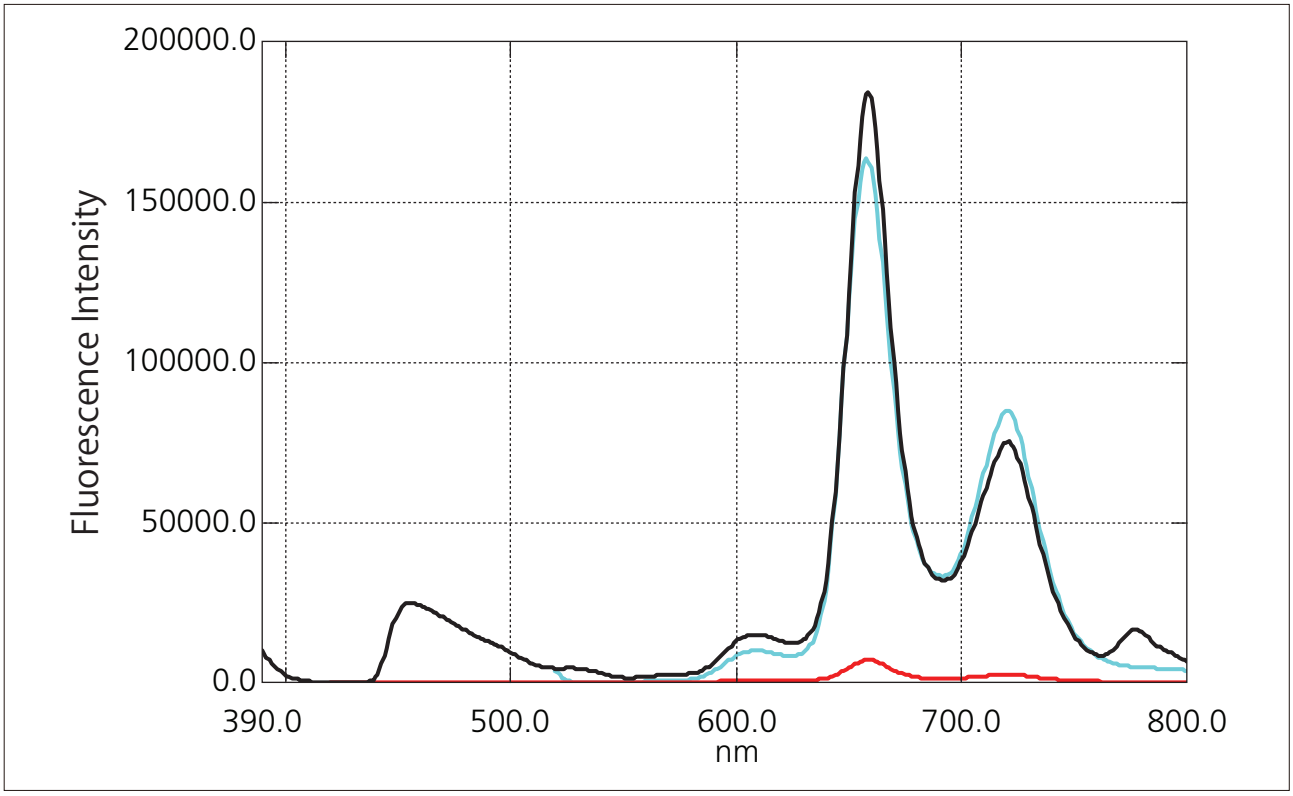

Fig. 3 Fluorescence Spectra of Porphyrin
Black line: Ex 390 nm, Red line: Ex 420 nm, Blue line: Ex 520 nm

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