3B07

Spectroscopy, Fluorescence and OLED

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Time resolved fluorescence emission spectra are routinely obtained by several methods. TRANES spectra are constructed by normalizing these spectra for equal area. The physical significance of TRANES spectra in fluorescence spectroscopy is that these spectra are the equivalent of time resolved absorption spectra in chemical kinetics. Oscillator strength and extinction coefficient in absorption spectroscopy are equivalent to the quantum yield and fractional quantum yield in fluorescence spectroscopy. Therefore, interpretation of TRANES spectra follows the same rules of interpretation of absorption spectra. Thus, an 'isoemissive point' in TRANES spectra (Figure 1) is the equivalent of 'isosbestic point' in kinetic spectrophotometry. That is, the chemical or physical kinetics involves two and only two species at all time. Rules for the interpretation of TRANES spectra where no isoemissive point is observed will be explained.

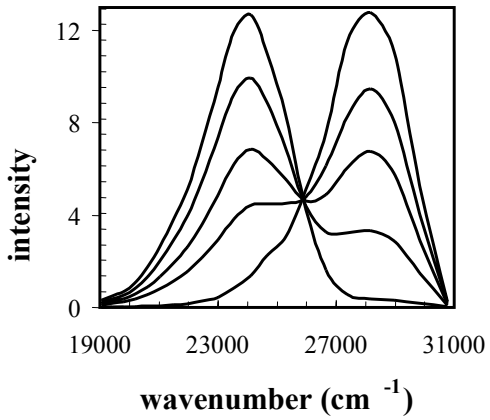

Figure 1: TRANES spectra with an isoemissive point

Anomalous results in spectroscopy have provided important insights. We shall give two examples of anomalous fluorescence. (i) Decrease of fluorescence lifetime of a dye molecule with increase in temperature is commonly observed and easily explained in terms of the temperature dependence of non-radiative process. Figure 2 (Left) shows an example of increase in fluorescence lifetime of STQ dye in a mixed solvent of methanol and dichloromethane at

higher temperature. This anomalous result was explained to be due to an ultrafast process in the excited state in which the solvent composition around the fluorophore is altered. (ii) Fluorescence properties of Tris(8-hydroxyquinolinato) Al(III), Alq_3 is anomalous in ethanol at low temperatures. For example, Figure 2 (Right) shows the blue shift of the emission peak as the solution is cooled and warmed between 300 and 80 K. The origin of this anomaly is not fully explained yet.

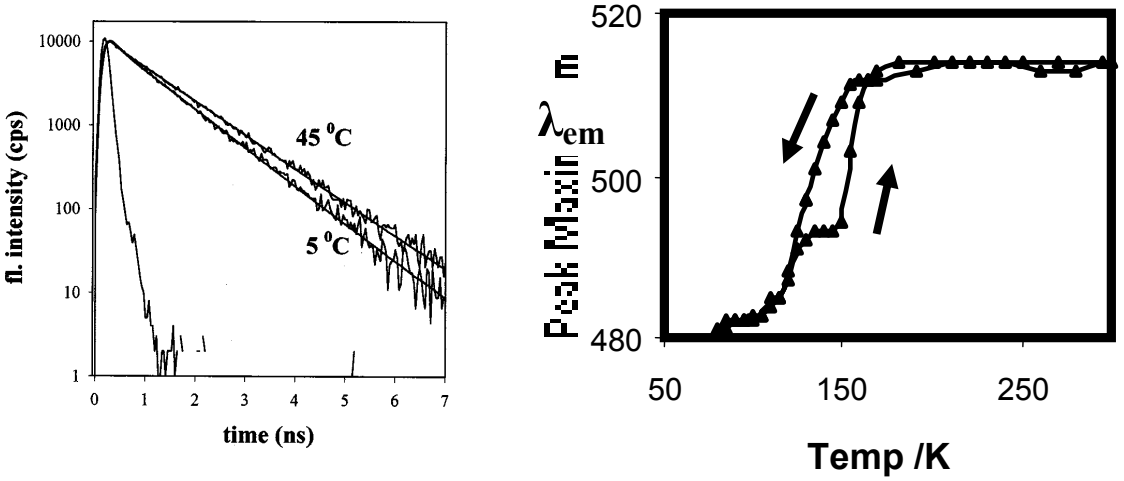

Figure 2: (Left) Fluorescence decays of STQ in mixed solvent. (Right) Temperature dependence of fluorescence emission peak of Alq_3 in ethanol

An example of formation of a new luminescent molecular species in OLED will be described.

References

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