Local Temperature of Fluorescent Centres in Polymer Films Determined from Universal Kennard–Stepanov Relation between Absorption and Fluorescence Spectra

A. Kawski, P. Bojarski, and B. Kuklinski

Luminescence Research Group, Institute of Experimental Physics, University of Gdansk,
ul. Wita Stwosza 57, 80-952 Gdansk, Poland

Reprint requests to Prof. A. K.; ul. Gen. W. Sikorskiego 11, PL-84200 Wejherowo. Fax:+48 58 34 13 175.

Based on the Kennard–Stepanov relation between the extinction coefficient and fluorescence intensity in their overlapping region, local temperatures T^* are determined for several dyes and stilbene derivatives in PVA and PVC polymers. It is found that excitation energy excess for $\tilde{v}_{exc} > \tilde{v}_{0\text{-}0}$ causes local heating in a rigid polymer, and the temperature difference $\Delta T = T^* - T$ holds during the emission process. Such a behaviour results from slow geometrical relaxation in a polymer. Excitation energy excess is also evidenced by the fact that the intensity distribution in the emission band depends slightly on the excitation wavelength. This effect is stronger for higher energy excess.

Key words: Universal Relation between Absorption and Fluorescence Spectra; Local Temperature; Polymer Fluorescent Solutions.