NOTE ON THE ACTIVE SPHERE OF LUMINESCENCE QUENCHING

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In the paper [1] HEVESI has pubiished his results about the fluorescence quenching of fluorescein in viscous solution with increase of concentration of the quenching molecules (KI). It was shown that, also in liquid media, the active sphere in JABŁOŃSKI's formula [2] describing the photoluminescence quenching by foreign substances depends on the diffusion coefficient D of the luminescent and quenching molecules.

The simple JABŁOŃSKI's formula for configurational quenching was first applied to the liquid solution in [3]. It was shown that in comparison with rigid solution, the active sphere in liquid solution is greater. The various values of the active sphere for liquid and rigid solutions indicate that it is necessary to introduce in liquid a "collision quenching" in addition to the configuration quenching.

According to HEVESI [1] the value of the active sphere a consists of two parts: one, independent of diffusion, being an effective sphere of configurational quenching and a spherical shell of radius $\sqrt{D\tau}$ around the effective sphere which is to be ascribed to diffusion. Therefore

$$a = A + B\sqrt{D\tau}, \tag{1}$$

where τ is the mean life-time of the excited state of the luminescent molecule for a given concentration of quencher. Only for small concentration of quencher can we suppose that $\tau \approx \tau_0$ (τ_0 mean life-time of luminescent molecule in the absence of quenching molecules).

Author of the present paper obtained another expression for the value of the active sphere of photoluminescence quenching of viscous solutions. According to the theory of diffusion it may be obtained the following formula

$$a = v + 4\pi DR\tau_0, \tag{2}$$

where R denotes the sum of the kinetic radii of the luminescent and quenching If $D=0$ (rigid solution), $a=v$ and we have only a configurational quenching.

For very small concentration of quenchers the JABŁOŃSKI's formula

$$\frac{\eta}{\eta_0} = \frac{1-e^{-an}}{en} \tag{3}$$

gives expression

$$\frac{\eta_0}{\eta} = 1 + \frac{1}{2}vn + 2\pi DR\tau_0 n \tag{4}$$

identical with the well-known VAVILOV—FRANK realtionship for viscous, quenched solution [4].

Fig. 1 shows that the experimental results of HEVESI [1] fit also very good with (2).

The detailed results of our investigations of the above problem will be published later.

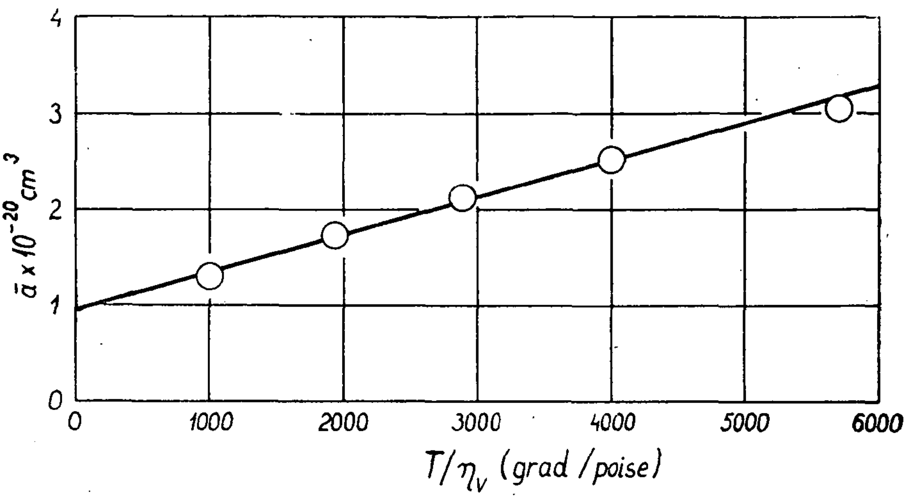

Fig. 1

References

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