

Laboratori Nazionali di Frascati

LNF-87/62

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Estratto da:
SIF - Conf. Proc. "Synchrotron Radiation at Frascati" Vol. 5, 185 (1986)

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P.O. Box, 13 - 00044 Frascati (Italy)

ALKALI HALIDES LUMINESCENCE EXCITED IN UV AND VUV REGION

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Luminescence spectroscopy is an important tool to study radiative de-excitation of excited states in solids⁽¹⁾.

Several processes are possible: direct electron-hole recombination, energy transfer to impurity centers and to lattice via electron-phonon interaction, creation of defects in electronic excited states.

In this frame we have investigated in potassium halides the relaxation of high excited states towards the emitting states and, in the case of Tl^+ -doped samples, the energy transfer between the excited atom and the thallium center⁽²⁾.

We have used the synchrotron radiation available at PULS VUV beam line as excitation source and recorded the excitation spectra for different emission bands in the temperature range 20-300 K in KI, KBr and KCl samples both pure and Tl^+ doped. The analysis of the data, so far almost completed only for KI, lead to the observation of new interesting results. For example:

a) The excitation spectrum at 20 K of $KI:Tl^+$ shows a preferential excitation of the emission band at 335 nm in the high energy component of the C absorption band of thallium (C3) while the 270 nm emission band is excited mostly in the low energy component of the C absorption band (C1) (Fig. 1). An analogous behaviour is also present at 77 K, when the 304 nm emission band is mostly excited in the C1, while the 426 nm band is excited in the C3 band.

b) Excitation in the first excitonic peak in pure KI ($\lambda=210$ nm at 20 K) produces a luminescence band much broader than that excited in the fundamental absorption band ($\lambda=175$ nm). The emission band in the former case is centred at 380 nm and contains the excitation π emission at 370

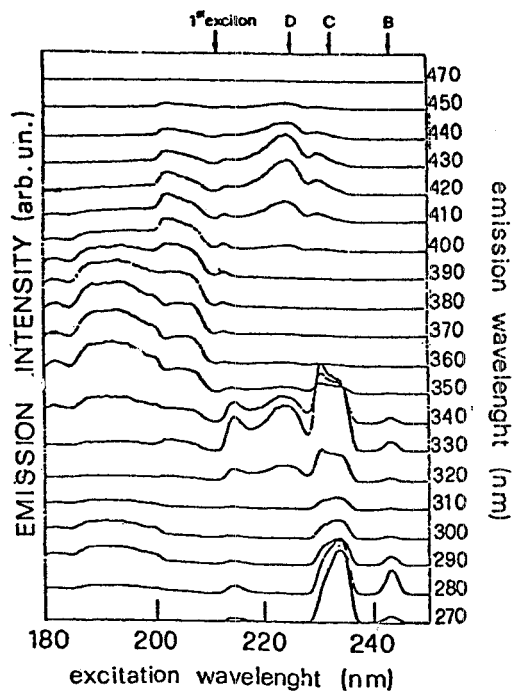


Fig. 1 - Excitation spectra of KI:Tl⁺ at 20 K taken at different emission wavelength. The arrows define the peak position of the main absorption bands of Tl⁺ and that of the first exciton in KI.

nm plus the contribution of the 408 nm band, attributed to exciton recombination localized close to a V_k^- center⁽³⁾. The behaviour of pure KBr is analogous and the excitation in the first exciton peak (184 nm) produces a new emission at 430 nm different from the σ and π luminescence (282 nm and 510 nm respectively).

c) Excitation in the high energy region (10-30 eV) at different temperatures gave valuable information on the energy transfer process. At room temperature we found in KI:Tl⁺ a strong luminescence due to the thallium 420 nm emission band and no intrinsic luminescence in pure KI. Instead, at liquid nitrogen temperature we have observed only the intrinsic luminescence of KI in both pure and doped samples, indicating that no energy transfer towards an impurity center occurs at this temperature in the Tl⁺ doped samples.

References:

- (1) D.Curie, Luminescence in Crystals (Methuen, 1963).
- (2) F.Antonangeli et al. J. Luminescence 31/32, 314 (1984).
- (3) M.Ikezawa and T.Kojima, J. Phys. Soc. Japan 27, 1552 (1969).