

FEATURES OF ELECTRONIC PROCESSES IN FILMS OF DYE - ACRIDINE DERIVATIVES
OF NATURAL ORIGIN

Ya.Vertsimakha¹, Yu.Skrushevsky¹, Renata Karpicz²

¹*Institute of Physics, NAS of Ukraine, 46 Nauki Prospect, Kyiv, 03648 Ukraine,*

²*Institute of Physic, Center for Physical Sciences and Technology, Savanoriu Av. 231, LT-02300
Vilnius, Lithuania*

**Corresponding author:yavertsi@iop.kiev.ua*

A comprehensive study of photoluminescence (PL), photovoltaic properties and IR reflection spectra for the films of acridine derivative - N, N-Dimethylquinacridone (DMQA) of natural origin has been performed. Films obtained by thermal vacuum evaporation on the quartz substrates and on the same substrate coated with a transparent coating to them conductive layer ITO or SnO₂. Thickness of films was 30-100 nm. Microscopic study of the investigated films morphology shown that they are polycrystalline with a small degree of orientation. This is confirmed by the fact that the infrared reflection spectra of DMQA films on Si- substrates consists mainly of the doublets at 1338-1470, 1556-1584, 3237-3271 cm⁻¹

Three bands of lowest electronic transition at 2.218 eV (width of 76 meV) and two bands connected with intermolecular electronic transitions at 2.56 and 3.3 eV are observed in the absorption spectrum of the film DMQA. Comparison of the absorption spectrum of solution [1] shows that during the formation of DMQA film significant (6.48%) intermolecular interaction (76meV), more than in films of molecular crystals (polyacenes) is observed [2].

Detailed PL measurements at different temperatures (5-250 K) indicate the existence for the films, in addition to the fluorescence band with a maximum at 2.0 eV, of two excimer photoluminescence bands with maxima at 1.74 and 1.66 eV, which are broadened at rise of temperature and finally fused to single broad band with a maximum at 1.7 eV [3]. The shape and energy position of photoluminescence peaks were independent on temperature in the 5 - 250 K.

The measurement of surface photovoltage under illumination from different sides shown that at the surface of the film the surface recombination rate is not great.

The data allows the hope that the films of DMQA are promising components for the development of hybrid organic heterostructures, photosensitive in a wide spectral range, for example with MPP [2, 4].

[1] *Chr.V.Gutsulyak, Ya.I.Vertsimakha R.Karpicz, Formation of Supramolecular Structures of N,N-Dimethylquinacridone in Binary Solvents, XXI International School-Seminar, Spectroscopy of Molecular Crystals, Book of Abstracts, September 22-29, 2013, Berogove, Crimea, Ukraine, p. 215.*

[2] *Ya. Vertsimakha, P. Lutsyk, p-n-Type HETEROSTRUCTURES BASED on N,N'-Dimethyl Perylene-Tetracarboxylic Acid Diimide, Mol.Cryst.Liq.Cryst., V.467,pp.107-122,2007.*

[3] *Yu.A.Skrushevski, J.APPL.SPECTROSCOPY, 2012-79, N 4.-p.576-583*

[4] *Ya. Vertsimakha, P. Lutsyk, K. Palewska, J. Sworakowski, and O. Lytvyn, Optical and photovoltaic properties of thin films of N,N'-dimethyl-3,4,9,10-perylenetetracarboxylic acid diimide, Thin Solid Films, 515,7950-7957 (2007).*