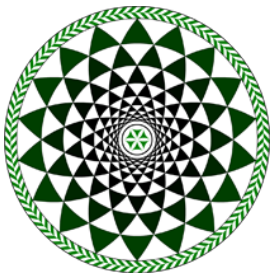

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Ultrathin molecular layers of fluorescent dyes for applications in organic luminescence diodes

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Organic semiconducting materials have attracted much attention due to their potential application in field effect transistors with organic gate (OFETs), light-emitting organic layers in diodes (LEDs), inexpensive and flexible photovoltaic cells (OPVs), and a large variety of sensors. Commonly, organic semiconducting materials are classified as either p-type (hole-conducting) or n-type (electron-conducting), depending on which type of charge carrier is preferentially transported through the layer of the semiconductor. Chemically stable organic p-type semiconductors have such properties that meet the requirements for use in many applications. However, n-type organic semiconductor, which are required for the manufacturing of complementary electronic circuits, are rare and much less developed. Nowadays, n-type materials possess low carrier mobility, are unstable in ambient condition, and pose difficulties in synthesis.
The n-type or p-type materials can be synthesized as derivatives of perylene-3,4:9,10-tetracarboxylic acid (Pn) with four lateral alkyl chains composed of n number of carbon atoms (n=2 – 13) and complementary molecules (PCn) with four chlorine atoms attached in bay position to the perylene core. Optical and electrical properties of this dyes are exceptional, and can be used in a variety of devices.
In this talk I would like to present the results of our experiments with two groups Pn and PCn of highly fluorescent perylene derivatives in the form of ultrathin layers prepared by spin-coating, Langmuir-Blodgett or Langmuir-Schaefer techniques and thermal evaporation in a high vacuum chamber. The molecular layers were deposited onto quartz plates for spectroscopic characterization and onto ITO electrodes for electrical measurements. For comparison the spectroscopic parameters of the dye investigated were measured in strongly dilute chloroform solutions and in the polycrystalline form. Fluorescence quantum yields of the ultrathin dye layers and the dye powders, the main optical parameter for emissive layers, were compared for both types of the dyes to find the influence of the substituents on spectral properties of the dyes. In order to do this, the intensity of the excitation and fluorescence were measured with high accuracy by using an integrating sphere. These techniques allow us to measure the absolute emission quantum yield even in the case of monomolecular films. Also textures of the films deposited by all used techniques were analyzed in nanoscale by using atomic force microscope AFM working in tapping mode.

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