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INVESTIGATION OF PHOTONICS OF DIPYRROMETHENE COMPLEXES TO CREATE OPTICAL MATERIALS BASED ON THEM

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Currently, the direction of photonics is actively developing, associated with the creation of optical materials and functional devices based on complex organic compounds. Information on the relationship between the structure of such compounds and properties allows one to formulate the scientific foundations for creating optical devices: active laser media, media for organic light-emitting devices, laser limiters, and optical sensors.

The spectroscopic and photochemical properties of dipyrromethene complexes in the ground and excited electronic states were studied. The results indicate the possibility of creating active laser media with a high lasing efficiency based on BF_2-dipyrromethenates. Binuclear bis (dipyrromethenates) exhibit a temperature dependence of the fluorescence intensity, which can be used in the development of optical sensors for determining temperatures in the range of 300-80K. The halogenated complexes of dipyrromethenes are characterized by the presence of phosphorescence with a high constant of quenching of triplets by oxygen. The presence of a straight-line dependence of the phosphorescence intensity on the oxygen concentration, high sensitivity, and fast response time – all this confirms the promise of creating an optical oxygen sensor based on halogen substituted dipyrromethenes.

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PHOTOPHYSICS OF 1,4-DIAZINE BASED D-(π)-A PUSH-PULL MOLECULAR SYSTEMS

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Organic molecules, which emit light in the field of applied voltage, have been widely used to create organic light-emitting diodes (OLEDs) in recent decades. Currently, screens of mobile phones, tablets, television sets, and on-board car computers are manufactured using OLEDs. Along with the obvious advantages of organic LEDs, such as high contrast and brightness, the ability to create devices on the flexible base surface and relative ease of manufacturing, there are a number of problems that scientists continue to work on. One of them is low internal quantum efficiency. It is related to the formation characteristics of light emitting centres in the OLED structure during electroexcitation. According to quantum statistics, 75% of the created excitons are in the triplet state and only 25% are in the singlet. It is known that the triplet state of most organic molecules is non-radiative, especially at room temperature. The exception is metal organic complexes based on precious metals, such as iridium. The OLEDs using such materials are highly effective, but quite expensive.

In 2012, in order to increase the efficiency of OLED structures, Adachi proposed the use of molecules with a high probability of reverse intercombination conversion (RISC) from the T1 state to the S1 state. In this case, a large proportion of the triplet excitons emit light in the form of thermally activated delayed fluorescence (TADF). To date, a large set of small molecules, dendrimers and polymers with TADF luminescence has been proposed for OLED. The key factor of RISC is the value of the energy gap between the S1 and T1 states. The smaller it is, the more likely the process of reverse intercombination conversion.