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# SPECTROSCOPY STUDY OF ORGANOMETALLIC COMPOUNDS BASED ON THE DIPYRROMETHENES WITH P-AND D-ELEMENTS

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The active research of dipyrromethene compounds is due to the broad prospects of their application in specific high-tech devices acting as fluorescent labels, optical sensors, probes, and photosensitive cells. The most promising representatives of this family are boron fluoride complexes of dipyrromethenes (BODIPY). Active laser media created on their basis (PM567, PM597) are characterized by intense radiation in the visible region of the spectrum and are successfully produced by a number of commercial firms. Nevertheless, in numerous publications mainly synthesis techniques are described, while there are not enough works on studying the relationship between structure and properties, which significantly complicates their application in other modern technologies. In this regard, the purpose of this work is to spectroscopic study the photoprocesses occurring in dipyrromethene complexes with different structures during their interaction with optical radiation in order to establish the possibility of using these compounds in modern optical devices.

The structures of some investigation compounds are shown in Figure 1. These complexes were synthesized in Institute of Solution Chemistry of the RAS (Ivanovo). The structure of complexes is confirmed by elemental and chromatography analysis [1]. Spectral-luminescent characteristics measured on spectrometer CM2203 according to standard procedures. Fluorescence, phosphorescence, luminescence excitation and emission lifetimes in the frozen (77 K) non-degassed ethanol were measured by the spectrometer Cary Eclipse. Laser experiments were carried out by the second and third harmonic of Nd:YAG laser.

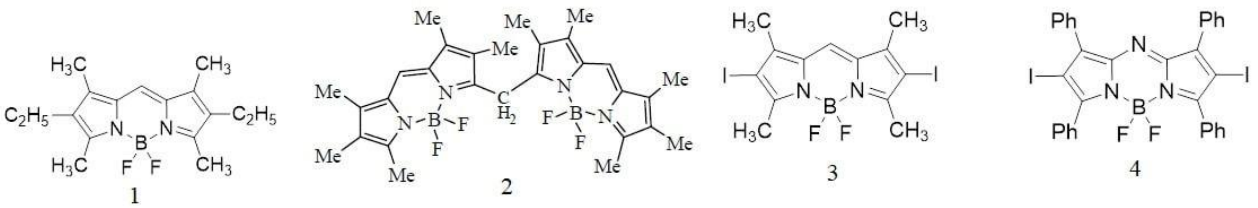

**Figure 1.** Structural formulas of coordination complexes of dipyrromethenes.

The results obtained on the study of spectroscopic and lasing properties indicate the possibility of creating laser active media based on the studied alkyl BODIPY (1) with high photostability and lasing efficiency [2]. Binuclear bis (alkyl-substituted) $BF_2$-dipyrromethenates (2) exhibit a temperature dependence of the fluorescence intensity, which can be used in the development of optical sensors to determine the temperature in the range of 300-80K [3].

The introduction of halogen atoms into the dipyrromethene ligand decreases the fluorescence efficiency and leads to the appearance of phosphorescence due to an increase in the yield of intersystem crossing by the “heavy atom” mechanism, which makes it possible to use such complexes to create sensory and photosensitizing media for singlet oxygen [2]. The use of Zn (II) and Cd (II) and ligands with meso-aza-substitution as a complexing agent increases the efficiency of nonradiative processes and the yield of triplets, decreases the lifetime of excited states, and increases molecular photostability. The quantum yield of phototransformations for the studied compounds upon irradiation of the second (532 nm) and third (355 nm) harmonics of Nd:YAG laser radiation is on the order of $10^{-5}$, which will make it possible to successfully use these compounds in the optical devices.

## References

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