The creation of organic injection laser – problems and achievements

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Currently, worldwide research is being conducted in the field of creation of thin-film organic lasers, with photo as well as with electrically pumped organic lasers. However, despite the active work in this direction, such laser based on organic compounds has not been produced yet. [1]. This is a complex issue and requires joint efforts of physicists and chemists, experts in the field of creation of semiconductor materials and structures on their basis, molecular spectroscopy, semiconductor physics, quantum and organic electronics [2]. The need for new original approaches to solve this problem is of paramount importance nowadays. One of such approaches is the creation of ordered organic systems in which to create a laser, it is possible to achieve the required characteristics of organic semiconductor structures – high mobility of charge carriers, large quantum yield of the radiation, reducing the likelihood of formation of non-emitting particles (excitons and polaronswith absorption bands in the visible spectral range).

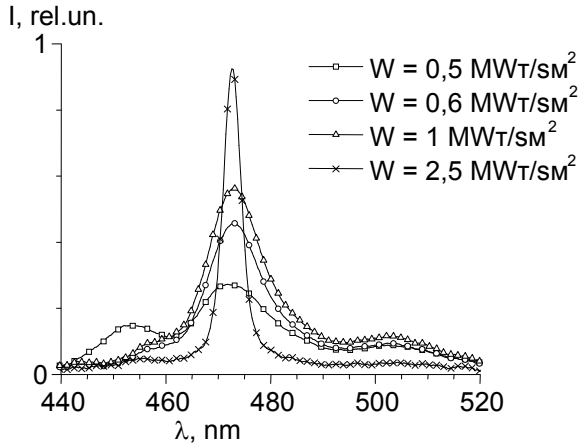

Fig. 1. The lasing spectrum in a polymer film doped with TIPS of different densities pumping

An experimental base necessary for the study of spontaneous (fluorescence, electroluminescence) radiation and stimulated emission of thin film structures of the selected semiconductor molecules 1,4-distyrylbenzene (DRC), 9,10 bis-[(triisopropylsilyl)ethinyl]anthracene (TIPS) and replaced polyfluorene (PFO) is being discussed in this report.

Thin-film structures based on them radiate with photo and electrically pumped organic compounds (tips: λэл = 452, 480 nm; PFO: λэл = 436, 463 nm). Their stimulated emission is obtained by pumped 3rd harmonic of YAG:nd3+ laser (DRC: gene λ = 412 nm; tips: the gene λ = 473 nm; PFO: gene λ = 432 nm). We investigate the possibility of pumping of such structures by led matrices. The possibility of measuring the mobility of charge carriers is condemned.

The prospects of creation on their basis of thin-film structures of lasers by the method of self-assembling are discussed as well.

Literature

[1] A. M. Balagurov, I. R. Holmes, S. R. Forrest, Phys. Rev. B 66, 035321 (2002).

[2] V. A. Pakoulev, Tn. Kopylova, S. Y. Nikonov, Telminov E. N., V. Burtman, Physical Science International Journal 5 (4), Pp. 230-240 (2015