TUNABLE SINGLE-MODE CW ENERGY-TRANSFER DYE LASER DIRECTLY OPTICALLY PUMPED BY A DIODE LASER

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Energy Transfer Dye Lasers (ETDL) exploit the excitation energy transfer between the molecules in various dye mixtures in order to obtain lasing in spectral range, inaccessible by direct optical pumping, as well as to increase the lasing efficiency [1]. The dye that absorbs the pump radiation and transfers the excitation energy is referred to as a donor, whereas the dye excited indirectly is called an acceptor. In certain cases the acceptor absorbs some part of the incident pump radiation and the excitation energy transfer increases the overall lasing efficiency. Though, it is also possible to achieve laser generation of the acceptor only by means of energy transfer from the donor.

In preliminary research carried out, the absorption and fluorescence measurements of binary dye mixture were performed. Coumarin 540 was used as a donor and Rhodamine 110 as an acceptor. The measurements were performed for different acceptor concentrations. The examined dyes were selected on the basis of the work [2], where such mixture was pumped by argon laser.

On the basis of the obtained data, examination of lasing efficiency of the stated mixture in a dye laser optically pumped by a diode laser (with output power of 4 W at 445 nm) was carried out. The output power of tens of milliwatts in the single-mode regime was obtained.

Since the performance of this mixture was not satisfactory for our purposes, due to the relatively low quantum yield of both dyes a mixture of other dyes: Coumarin 498 (donor) and Pyrromethene 556 (acceptor) was introduced. The lasing efficiency of Coumarin 498 under the conditions of diode laser pumping was already comprehensively determined by the authors [3], whereas the selection of the acceptor was based on the reported literature data [4].

Fairly efficient laser generation under identical pumping conditions as previously stated was achieved, obtaining a few hundreds of milliwatts of output power. A tunable single-mode regime, suitable for high resolution spectroscopy, was also achieved and tested [5]. The fluorescence and absorption properties of the exploited mixture are still under examination.

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