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TUNABLE SOLID-STATE DYE LASER DOPED BY CHROMEN-3 AND PM-567

Solid-state active laser media using PMMA matrices doped by Chromene-3 and PM-567 were created. Their lasing and spectral properties are investigated. Fluorescence bandwidth is wide enough for tunability (near 40 nm full-width on the half maximum - FWHM). The photostability is number of the pulses in one dot needed to decrease efficiency twice – near of $3*10^5$ pulses are obtained. The obtained data lead to the development of the tunable solid-state laser on the basis of the investigated LAE demanded in medicine.

***Key words**: dyes, solid-state laser ractive media, tunable laser.*

Introduction

Chromene-3 (3-diethylamino-7-imino-7H-chromene[3′,2′-3,4]pirid[1,2-a]-benzimidazol-6-carbonitryl) and 4,4-difluoro-1,3,5,7,8-pentamethyl-2,6-diethyl-4-bor—3a,4a-diaza-s-indacena (PM-567) are cumarine complexes. Their fluorescence spectrum is red and therefore these dyes are demanded in biomedicine. They can be used for cosmetic surgery, vascular disease treatment and for physiotherapy. The Chromene-3 was synthesized in the Research Institute of Organic Intermediates and Dyes in Dolgoprudny.

The purpose of the study is to investigate Chromene-3 and PM-567 lasing and spectral properties in solid-state medium and define their suitability for tunable laser application.

Experiment

The Scheme [1] is used to investigate the laser performance and spectral characteristics of the chosen dyes. Nd:YAG LQ – 529 laser excites sample with 532 nm wavelength and 10 ns pulse duration. The Systems of non-selective filters allows us to control the pumping power density and find an optimal one. Generated radiation's energy is obtained.

Avantes spectrometer is used for luminescence and generation spectrum investigation.

Results and discussion

Laser performance

High efficiency achieved in the experiment allows us to establish suitability of the chosen dyes for laser needs (fig. 1). Since for the continuous variation of the generation wavelength, it is obvious that efficiency decreases when generation band comes close to the edges of luminescence contour.

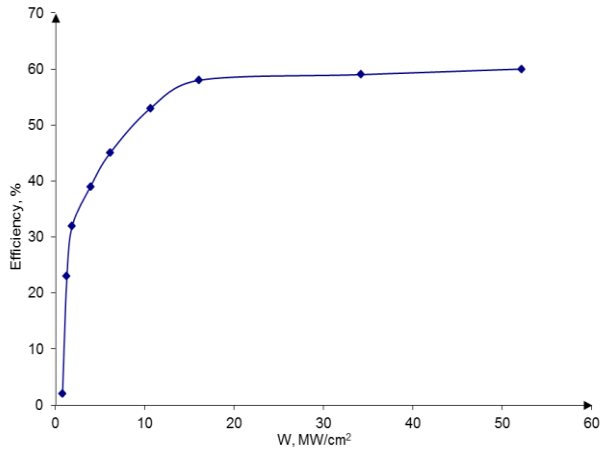

Fig. 1 –Dependence of efficiency on pumping power density for LAM with PM-567 concentration 10^{-3} mol/l

Spectral characteristics

The aim is to investigate the sample generation process, determine the luminescence and generation band FWHM. The generation and luminescence intensity dependence on wavelength are shown further (fig. 2).

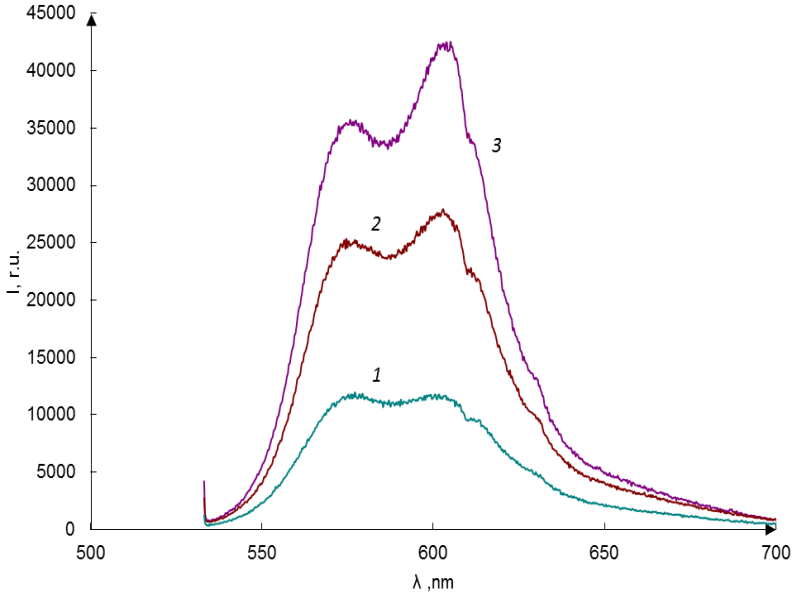

Fig. 2 – *1* – Spectral curve obtained with pumping power density W=10 MW/cm^2; *2* – with pumping power density W=20 MW/cm^2; *3* - with pumping power density W=30 MW/cm^2; concentration of Chromene-3 in sample is 5*10^{-3} mol/l.

The Obtained results and earlier investigations [1-3] allow us to prove the possibility of creation of tunable pulsed laser on the basis of Chromene-3 and PM-567 with high photostability and efficiency.

REFERENCES

1. Investigation of the solid-state laseractive media based on pyrromethene 567 / T. N. Kopylova [et. al.] // Russian physics journal. – 2012. – V. 55. – № 10. – P. 32-37.(in russian)
2. Spectral, luminescrnt and generation characteristics of red-spectrum organic luminophores / A. K. Aymuhanov [et. al.] // Ocean and atmosphere optics.- 26.-V. 10.-P.871-876. (in russian)
3. Solid active media for tunable lasers of orange range's part D. S. Tabakaev, E .N. Telminov,TT. A. Solodova, E. N. Ponyavina // Russian physics journal. V. 56. – №. 9/2. – P. 73-75. (in russian)

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