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Investigation into the potential of Random laser action on bacterial nanocellulose aerogel with rhodamine 6G acting as gain medium.

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Random Lasers (RL) are widely used due to their low production costs and versatility in solutions, solids and powders. Unlike conventional lasers (CL), random lasers use the principle of backscattering light in a diffuse medium, which requires a gain medium and scattering centers that act as mirrors, directing and reflecting the light internally in the medium. (1) As a gain medium, molecules with high fluorescence quantum efficiency such as Rhodamine 6G and B are used. Random Lasers have important characteristics such as low or almost zero spatial coherence, which can be useful in applications such as optical imaging, for example, where the appearance of speckle must be avoided. (1) The scattering centers are particles of the same wavelength or even smaller, such as titanium oxide (TiO_2), zinc oxide (ZnO) and eggshell membranes. (2) In this work, the occurrence of RL action was observed in bacterial nanocellulose (BC) aerogel that had been coated with SiO_2 and doped with Rhodamine 6G (Rh6G) dye. The process of nanocellulose production is carried out by bacteria of the genus *Komagataeibacter xylinus* (classified as Gram-negative, strictly aerobic, and non-photosynthetic) through a biosynthetic pathway. This involves the conversion of glucose, glycerol, and other organic substrates into cellulose within a few days. The preparation of the SiO_2-coated bacterial cellulose hydrogel (BC@SiO_2) was conducted in accordance with the methodology previously described by Almeida da Silva *et al*. (3) The experimental procedure used a 1064 nm Nd:YAG Laser operating in Q-switched mode in its second harmonic with a wavelength of 532 nm, at a repetition rate of 20 Hz and a temporal width of 10 ns. All the samples have the same concentration of Rhodamine 6G and are differentiated by their thickness, BC1 = 0.6 mm; BC2 = 1.1 mm; BC3 = 1.7 mm. The samples showed similar behavior, with a narrowing of the emission band, compared to Rhodamine 6G's FWHM value of approximately 40 nm, samples BC1, BC2 and BC3 thinned by a factor of 5 and an average value of 6 nm was found between them. The energy threshold was also very close, with a minimum value of 40 μJ needed to overcome spontaneous emission and reach stimulated emission.

Palavras-chave: Random laser; Bacterial nanocellulose; Optics and photonics.

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