Random Laser Emission Tuned by Surface Diffraction Gratings in Laser Dye Doped Polymeric Resin

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Random laser (RL) devices have been gaining considerable attention due to applications as a source of monochromatic light, presenting a series of properties that differentiates it from other sources of light. Its architecture is simple and cheap to produce in large quantities, even on microscopic scales [1]. The produced light is spatially incoherent and generates speckle-free signal, optimal for imaging [2], and random number generation is possible in the coherent laser interval [3]. With these and other properties, random lasers have potential as a monochromatic source, and it is beneficial to develop techniques for better control of emission for application optimization.

In this work, we proposed to tune the RL emission by using diffraction gratings. In this way, the samples used for this study were mainly composed by a polymeric resin, in which the diffraction grating were printed, and, as gain medium, Rhodamine 6G dye was used. This technique is analogous to tuning in usual lasers with broad spectrum, in which gratings are added intra-cavity and select a narrow band of wavelengths to be amplified [4]. To produce superficial diffraction gratins on the RL structures, the resin is deposited on a substrate that has already a physical grating, which molds the resin while the hardening process of polymerization takes place. This is fast and a low cost process for manipulation of RL architectures, even DVD discs can be used as a substrate to produce the gratings. As a main result, it was noted that the RL emission is dependent on the angle of measurement and a significant wavelength tuning is observed due to the presence of the diffraction grating.

References

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