Supporting Information

Structural and optical properties of Nd:YAB-nanoparticle-doped PDMS elastomers for random lasers

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SI1. Raman spectra of the $Nd_xY_{1-x}Al_3(BO_3)_4$ nanopowders

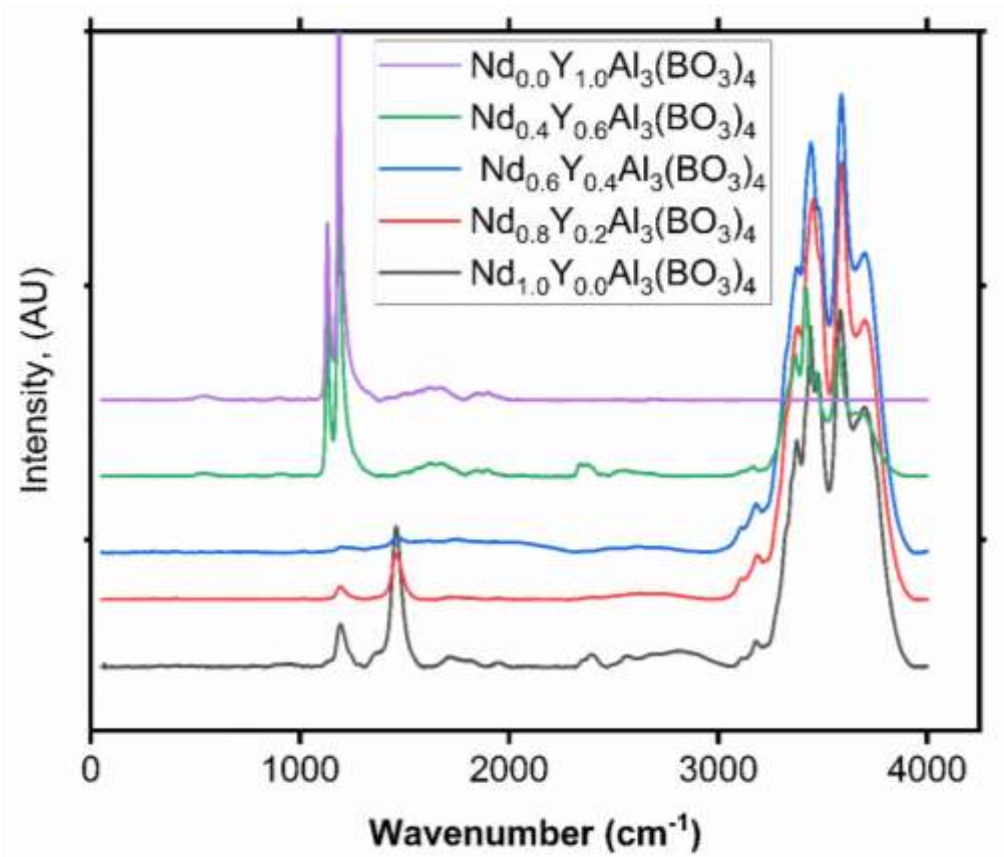

Fig. S1: Raman spectra of the $Nd_xY_{1-x}Al_3(BO_3)_4$ nanopowders (x between 0 and 1) from 200 to 4000 cm^{-1}, under excitation at 633 nm from a He-Ne laser

SI2. Thermal Studies DSC and TGA

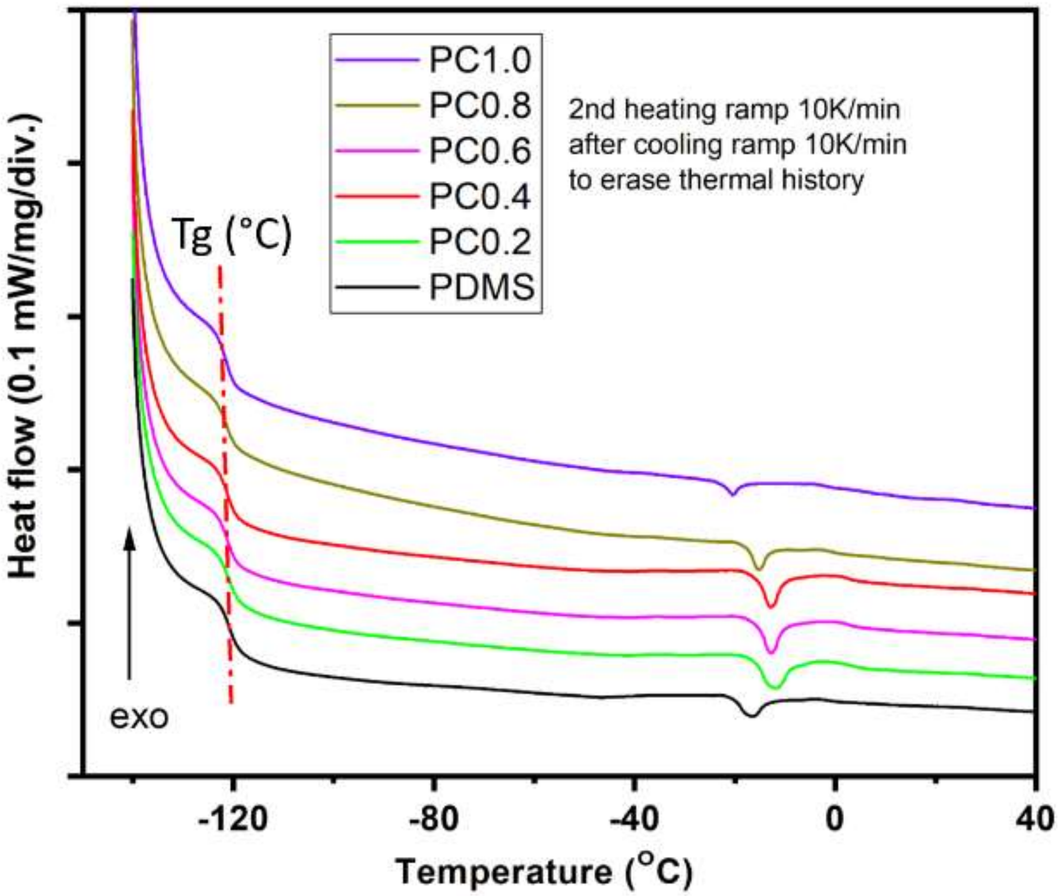

Fig. S2. DSC traces were recorded at a heating rate of 10K/min under helium atmosphere. Offset DSC traces of the second cooling ramp from 40°C to -150°C.

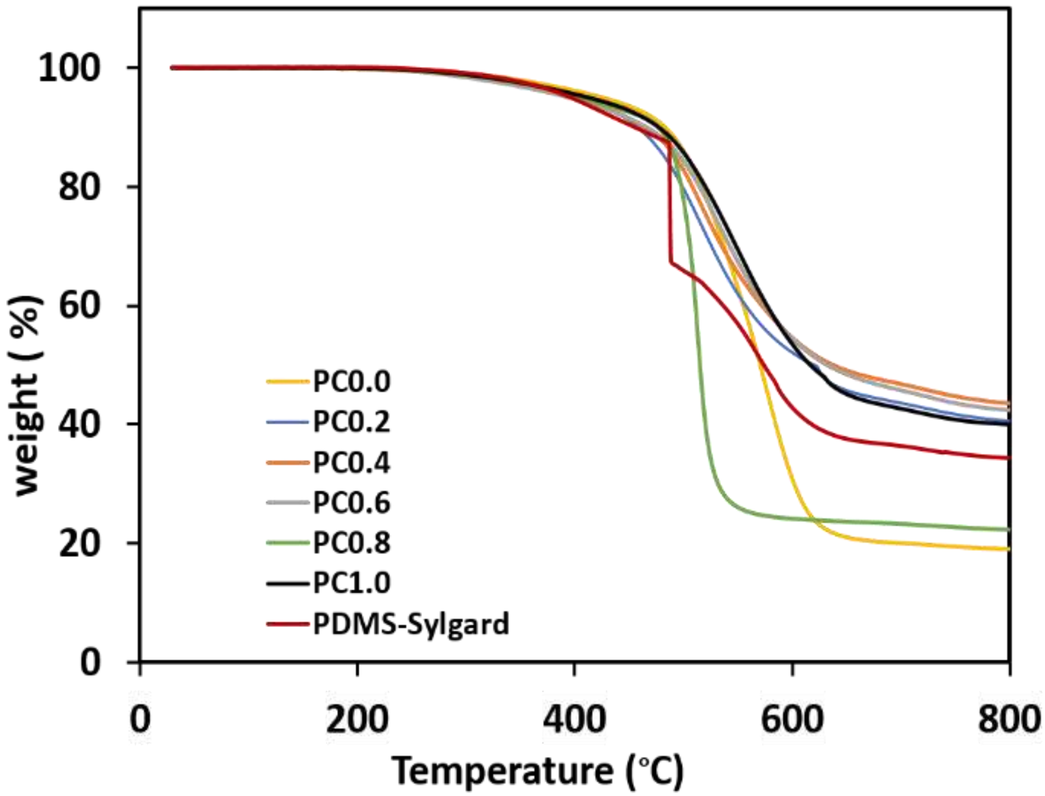

Fig. S3. Thermogravimetric analysis TGA curves of PDMS-Sylgard polymer and composites with Nd:YAB nanocomposites.

All the samples were heated up to 800°C with a constant rate of 10°C min^{-1} under 25 $mL.min^{-1}$ nitrogen streams. PDMS shows weight-loss stages which located in 220°C-450°C and 450°C-580°C which results from the PDMS degradation and hydroxyl breakage (dehydration, Evaporation of LMWS) where all the composites give one weight losses.

S13- Random lasing emission

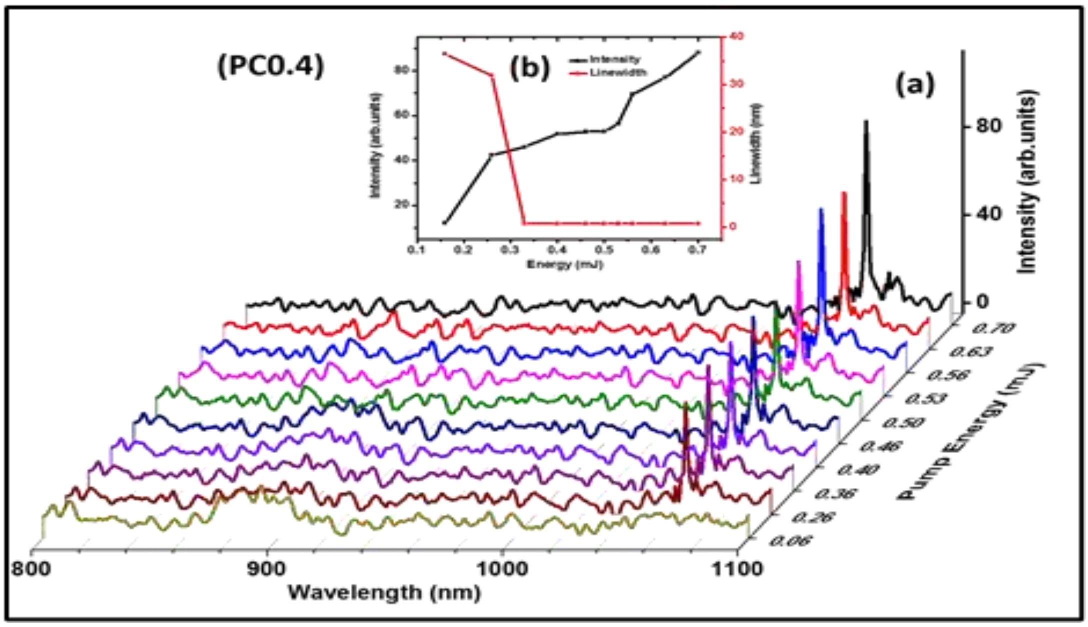

Fig. S4. a) The emission spectra obtained from $Nd_{0.4}Y_{0.6}Al_3(BO_3)_4$polymer composite. The threshold is 0.26 mJ. Further increase in the power, the peaks narrows to a linewidth of 0.87 ± 0.10 nm, Inset shows the FWHM (red circles) and maximum emitted intensity (black circles) dependency on pump energy of the sample $Nd_{0.4}Y_{0.6}Al_3(BO_3)_4$ polymer composite.

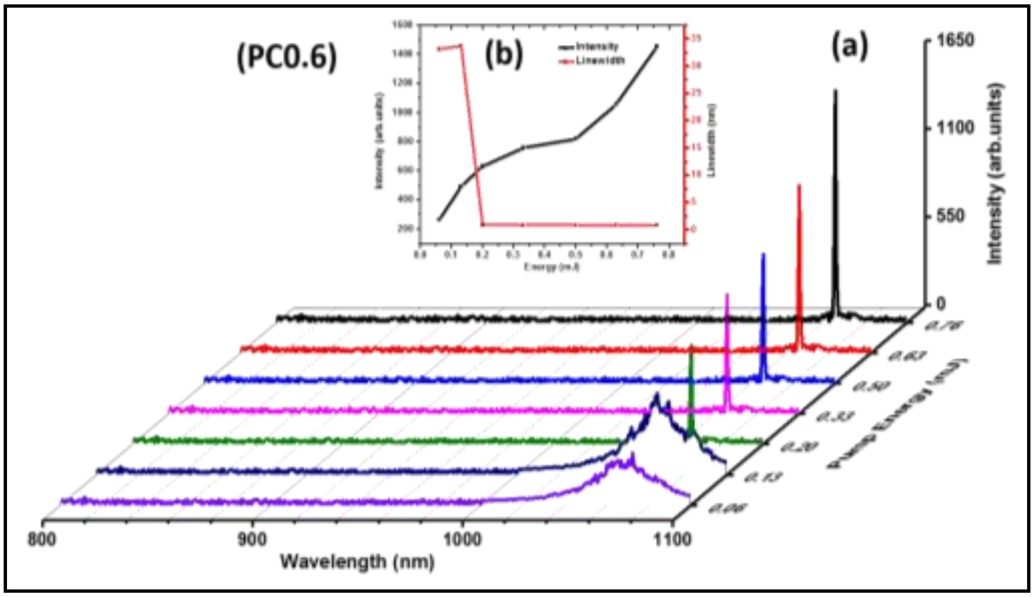

Fig. S5. a) The emission spectra obtained from $Nd_{0.6}Y_{0.4}Al_3(BO_3)_4$polymer composite. The threshold is 0.20 mJ. Further increase in the power, the peak narrows to a linewidth of 0.88 nm ± 0.10 nm. b). FWHM (red squares) and maximum emiited intensity (black circles) dependency vs. pump energy.

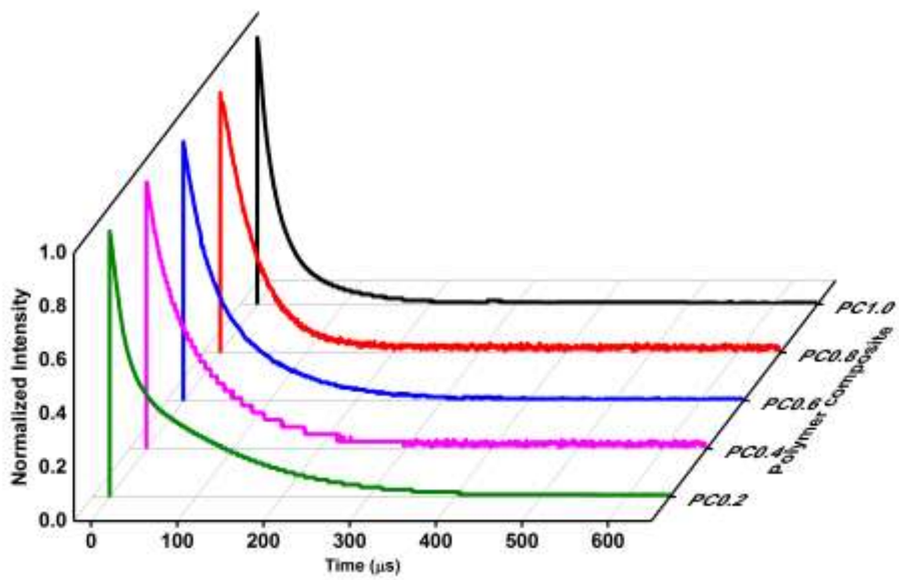

Fig. S6. The emission lifetime decay curves for all the polymer composites at an excitation wavelength of 532 nm.

SI5- Stretching studies on polymer composites.

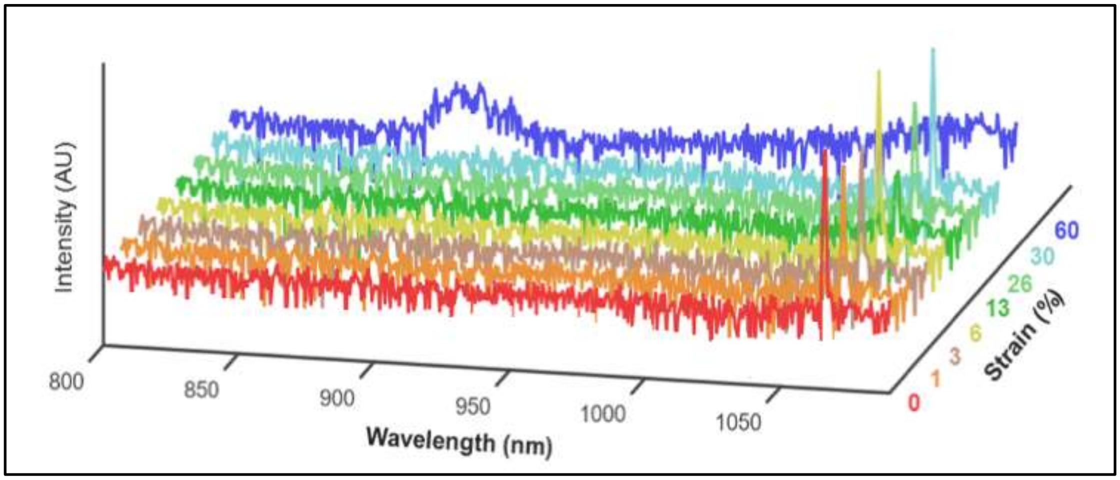

Fig. S7. The RL emission intensity as a function of strain $\Delta L/L$ (strain) applied to the PC0.2 elastomer ($Nd_{0.2}Y_{0.8}Al_3(BO_3)_4$) from 0 to 60%.

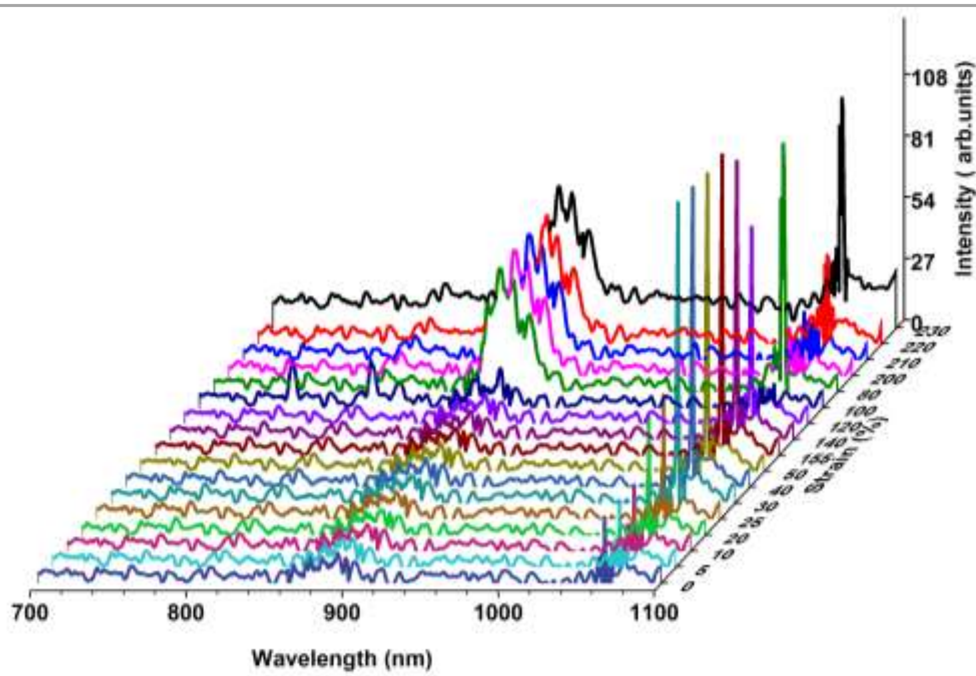

Fig. S8. The emission intensity of the PC0.4 elastomer Nd: YAB ($Nd_{0.4}Y_{0.6}Al_3(BO_3)_4$), as a function of strain ($\Delta L/L$) from a) 0 to 50 %, b) 80 to 155 % and c) 200 to 230 %.

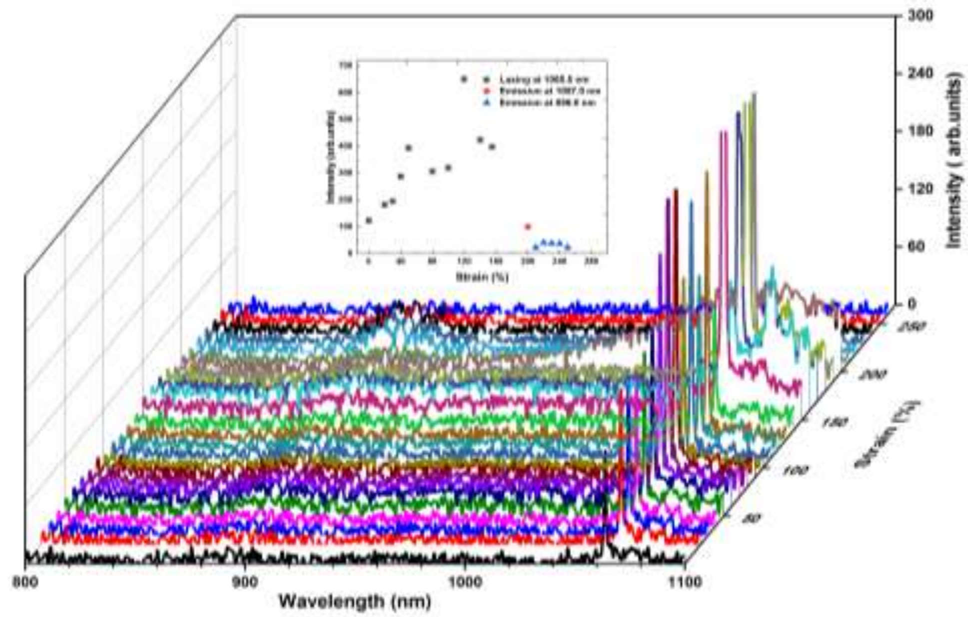

Fig. S9. The RL emission intensity as a function of ΔL/L (strain) applied to PC0.6 elastomer Nd:YAB ($Nd_{0.6}Y_{0.4}Al_3(BO_3)_4$). The lasing at 1065.95± 0.5 nm was sustained up to 270 % of strain.

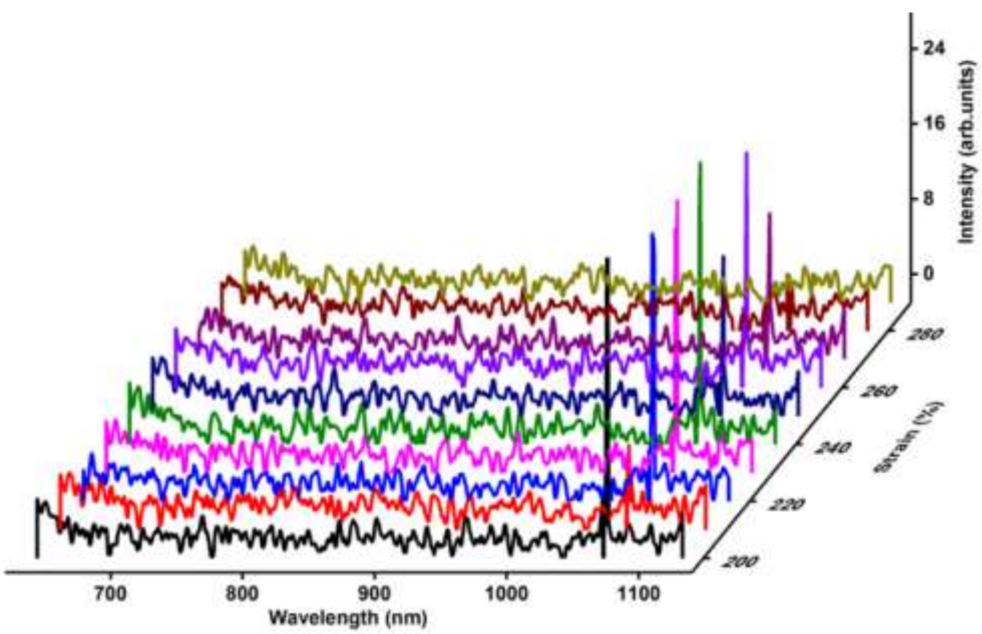

Fig. S10. The RL emission intensity as a function of ΔL/L (strain) applied to PC1.0 elastomer Nd:YAB ($Nd_{1.0}Al_3(BO_3)_4$). The lasing emission at 1066.9 ± 0.5 nm was maintained up to 300 % of stretching.

Fig. S11 shows 1,000 spectra for the PC0.8 polymer composite at each pump energy, from which the intensity fluctuations can be appreciated in the regimes below (a), around (b), just above (c), and far above (d) the RL threshold. The strong intensity fluctuations observed around and just above the threshold (Fig. 5(b) and 5(c)) suggest that the PDF of the output intensities can be described by the family of Lévy α-stable distributions, including a Lévy-like statistical regime if $0 < \alpha < 2$ and the and the Gaussian distribution if $\alpha = 2$[25-33].

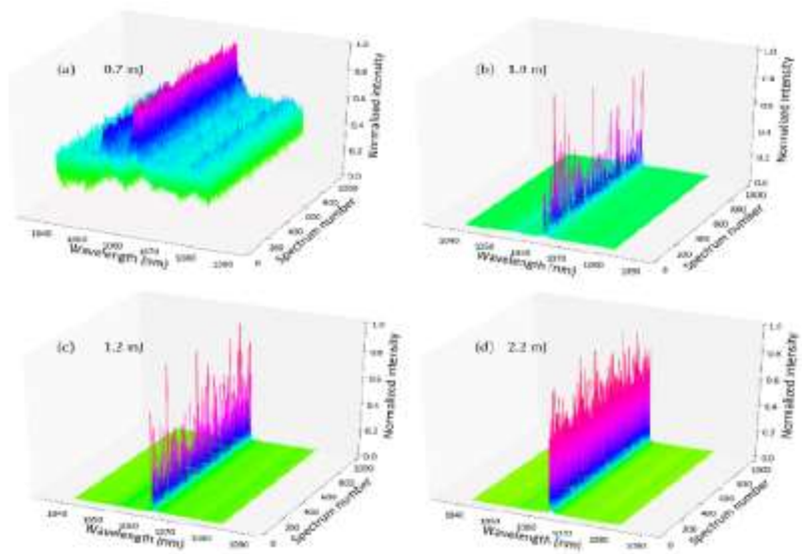

Fig. S11. 1,000 spectra for each pump energy considering the regimes below (a), around (b), just above (c), and far above (d) the RL threshold for the polymer composite PC0.8.