Polydispersed Powders (Nd^{3+}:YVO_4) for Ultra Efficient Random Lasers

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Random lasers hold the potential for cheap, coherent light sources that can be miniaturized and molded into any shape with several other added benefits such as speckle-free imaging and cancer detectin, however, they require improvements specifically in terms of efficiency. This talk details for the first time a strategy for increasing the efficiency of a random laser that consists in using smaller particles, trapped between large particles to serve as absorption and gain centers whereas the large particles control mainly the light diffusion into the sample. In order to to determine the samples' transport mean free path, fill fractions, laser efficiency and the average photon path lengths inside the scattering medium for backscattered pump photons, measurements of backscattering cone, sample absorption, reflection and laser emission are done. A record slope efficiency of 50% is reached by optimizing pump photon diffusion and absorption in a powder pellet composed by a polydispersed particle size distribution (smaller particles between bigger ones) from a grinded and sieved 1.33 mol% Nd:YVO_4 crystal with mean particle size of 54 micrometers.