Dependency of Absorbed Light in Powders of Nd^{3+}:YVO_4 with Different Grain Sizes and Applied Pressure

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Abstract: This work explores the relation between the absorption and reflectivity of several powders of Nd^{3+}:YVO_4 with different grain sizes. To do that, this powder was analyzed in a spectrometer with a calibrated integrating sphere. With that we obtained the reflectivity curve of the samples and calculated the ratio between the maximum of reflectivity and the maximum of absorption, which result in smaller grains absorbing more light.

1. Introduction

The possibility of generating stimulated emission in scattering media with gain (random laser) was historically proposed by Letokhov in 1960s [1,2] and experimentally demonstrated in 1993 by Gouedard et al. [3]. This leads to a new type of lasers that are cheaper than regular lasers. To achieve that, it's necessary optimization of random laser performance with respect to radiance and efficiency. In a previous work [4] was study the dependence of different particle size and applied pressure on powders of Nd^{3+}:YVO_4 have on random laser emission.

In this work we study the dependency of absorbed light in the same powder to determine which composition is more efficient to enhance absorption. These powders were separated in two groups, one with mixed particles sizes (group A) and other cleansed to get a monodispersed particle size (group B). Surface reflectivity (Fig. 1) was measured at 705 nm (zero absorption of neodymium ions) and absorption at 805 nm (absorption peak of neodymium) using a spectrometer with a calibrated integrating sphere (Agilent Technologies, model CARY-5000). After that we calculated the ratio between the peak of maximum absorption and the surface reflectivity, which are shown on Table 1.

2. Results and discussion

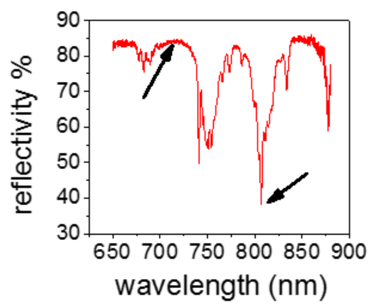

Fig. 1. Absorption spectrum of one of the samples indicating the points where the max reflectivity and the max absorption were acquired.

Table 1. Ratio between max reflectivity and the max absorption.

group A		group B	
A_1	1.59	B_1	1.40
A_2	1.71	B_2	1.64
A_3	1.94	B_3	1.86
A_4	2.04	B_4	2.02
A_5	2.04	B_5	1.95

The results above bring information about the radiation loss through reflection and the radiation absorption inside the material. With that we can determine which sample is most efficient to absorb light. Looking at table 1, we can conclude that powders with small size are more efficient at absorption of light.

3. References

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