Yb^{3+} ions distribution in YAG nanoceramics analyzed by both optical and TEM-EDX techniques.

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Streszczenie

We show the approach in the structural and spectroscopic analysis of Yb^{3+}-doped YAG nanoceramics prepared using the low temperature-high pressure sintering technique (LTHP) by conjugation of both TEM-EDX and optical techniques. Pressure sintering dependences of absorption, emission, and decays are analyzed and interpreted. The sample pressurized at 8 GPa for sintering is characterized by the highest transparency and confirms the $Y_3Al_5O_{12}$ garnet structure of the grains of ∼21 nm average size. Yb^{3+} ion distribution has been analyzed by both TEM-EDX evaluation in grains and grain boundaries and spectroscopy of Yb^{3+} pairs of small population from the co-operative luminescence phenomenon. EDX analysis at the TEM scale provides unambiguous results on a clear tendency of almost uniform Yb^{3+} distribution. An important new observation has been made at 4 K and room temperature with the $^2F_{7/2} \rightarrow {}^2F_{5/2}$ 0-phonon absorption line located at 975.7 nm, in addition of the 0-phonon line of the YAG structure of grains at 968 nm similar to that of bulky YAG single crystals. We have discussed the origin of this new 0-phonon line relaxing only by nonradiative transitions and conclude that this line might be assigned to Yb^{3+} distorted sites on the grain surfaces.

Adres publiczny

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Strona internetowa wydawcy

https://www.acs.org/content/acs/en.html