Synthesis and optical properties of erbium doped BaF_2 and Y_2O_3 materials

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Abstract

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Light is a crucial source of energy for life on the earth and important resource for extra-terrestrial space exploration. Synthesis of optical materials allowed the light to be controlled and important applications to be developed like lasers active media, optical fiber amplifiers, luminescent solar concentrators, fluorescent markers etc. Different synthesis approach may give materials with new light emission properties. The impurities, their concentration and distribution in materials influence the emission of light.
In this work we used vertical bridgman and co-precipitation techniques to obtain BaF_2,Y_2O_3 hosts and doped them with Er^{3+} ions. We investigate light absorption, photoluminescence and correlate the measured radiative lifetime with theoretical calculated using Judd-Ofelt model. We observe new unreported emission in UV centered at 321 nm corresponding to the $^2P_{3/2} \rightarrow {}^4I_{15/2}$ transition in Er^{3+} ions under 290 nm excitation, for BaF_2 obtained using modified Bridgman technique [1,2]. Also for Y_2O_3:Er unreported green emission under 380 nm excitation was found.

Conclusions
New light emission band in UV at 321 nm was observed in BaF_2 obtained using different Bridgman technique with a shaped graphite furnace. The Er^{3+} ions was not uniform distributed along the BaF_2 crystals and the intensity of the absorption bands depends not only on the Er^{3+} concentration but also on the position of the sample in the BaF_2. The higher concentration of Er^{3+} ions in Y_2O_3 shows a unusual emission band at 561.7 nm.

References
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