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Phase Diagram of the System LiF-GdF_3-YF_3

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$LiGdF_4$ crystals have an important application as laser active media when doped with rare earth ions[1]. The LiF-GdF_3 phase diagram presents two invariant points: a eutectic at 25 mol% GdF_3 and 698 °C, and a peritectic at 34 mol% GdF_3 and 750 °C. GLF is the unique intermediary compound. In a previous paper [2] it was investigated the codoping of GLF crystals with yttrium, and good quality crystals could be obtained using the peritectic composition of the system LiF-GdF_3 as starting composition.

In this work the phase diagrams of the system LiF- $Gd_{(1-x)}Y_xF_3$ (x= 0,5 e 0,75) have been constructed using differential thermal analysis. The measurements were performed with samples weighing around 50 mg placed in open platinum crucibles, under a flux of purified helium, with a heating rate of 10 °C/min. The phase diagrams were determined up to compositions of 40 mol% LiF: 60 mol% $Gd_{(1-x)}Y_xF_3$.

To determine the phases present in the phase diagrams, some samples were melted under a flux of hydrogen fluoride gas and cooled at rates of 10-20 °C. One of the samples was observed using a scanning electron microscope with

temperature and from 100 to 600°C, in steps of 100°C. The patterns were analyzed by the program DBWS-9807a [3] which makes the refinement of the structural parameters using the Rietveld method. The variations of the parameters with the temperature were fitted to third-order polynomials. The parameters behave in a way which is compatible to the thermal properties of the compounds. The measured lattice parameters of Cr:LiCAF are larger than those of pure and Ce:Na-doped crystals, which showed very similar values. The same was not observed for LiSAF host. The measured lattice parameters of Ce:Na:LiSAF are larger than the observed values of pure and Cr-doped LiSAF.

References:

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