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OPTICAL PROPERTIES OF THE CHROMIUM DOPED FLUORIDE GARNET: $Na_3In_2Li_3F_{12}$

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The Garnet-type cryolithionite has been studied as a new host material for tunable laser emission of trivalent chromium.

The lower crystalline field of fluorides compared to oxides favours the chromium emission in the $^4T_2$ - $^4A_2$ low energy band, instead of narrow ^2E - $^4T_2$ line in strong fields. Furthermore, garnet is one of the crystalline structures which provides the greatest amount of lattice phonons, available for removing the forbiddenness of the transition, and for broadening the chromium emission band.

Powders of $Na_3In_2Li_3F_{12}$ doped with 1% chromium in the octahedral indium site have been synthesised by solid state reaction for preliminary investigations.

Fluorescence and excitation spectra of Cr^{3+} have been recorded from 10 K up to room temperature.

The emission spectrum, corresponding to the $^4T_2$ - $^4A_2$ transition, is centered at 0.77 μm. at 300 K, with a bandwidth of 130 nm. The intensity of the band increases with temperature, indicating a good phonon coupling.

The excitation spectrum allows the assignment of the $^4T_2$ band at 0.63 μm., and of the $^4T_2(^4F)$ band at 0.438 μm. According to the method given by Struve and Huber [App. Phys. B37, 1-7 (1985)], the Tanabe-Sugano coefficient is calculated to be Dq/B = 2.1. The fluorescence lifetime is 316 μs. at 300 K and 672 μs. at 10 K, revealing the admixture of the $^4T_2$ with the ^2E level.

The broad band emission and the relatively long lifetime of Cr^{3+} are good arguments to point out this cryolithionite garnet as a promising material for room temperature, tunable and Q-switchable laser.

The syntheses of single crystals are in progress.