Strategies for increasing Cr^{4+} content in YAG:Cr matrix for laser applications

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Chromium-doped crystals are widely used in various domains including optical devices, saturable absorbers for pulsed lasers or thermometry devices[1][2]. Yttrium Aluminum Garnet (YAG) is an excellent matrix to host chromium ions due to its mechanical and optical properties. In this matrix, chromium ions can be found in two crystallographic sites (octahedral and tetrahedral) and under two oxidation states (Cr^{3+} and Cr^{4+}). Depending on the chromium ions oxidation state and on the place they occupy, YAG:Cr compounds are more suitable as phosphor or as saturable absorber. This study presents the synthesis of YAG:Cr powders using the Pechini process. The oxidation of chromium ions in the matrix was achieved by co-doping with a charge-compensating ion and/or the use of an oxidizing agent during synthesis. The structural, morphological and optical properties of the powders were studied. UV-Visible spectroscopy shows the appearance of absorption bands associated with Cr^{4+} ions after optimized synthesis conditions (Figure 1a). Emission spectra confirm the presence of these ions in YAG:Cr produced under oxidizing conditions (Figure 1b). The influence of the synthesis parameters on the optical properties will be discussed

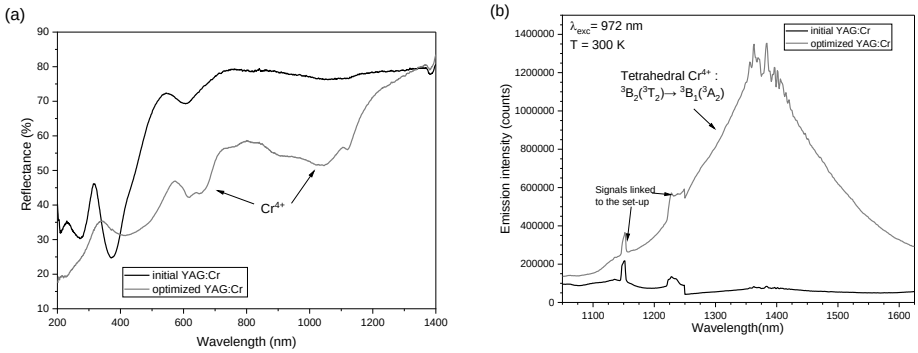

Figure 1: (a) UV-Visible spectra of YAG:Cr powders recorded in diffuse reflection and (b) emission spectra of the same powders excited by a continuous laser source at 972 nm.

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