ELECTRONIC STRUCTURE OF $Y_3AL_5O_{12}$: V SINGLE CRYSTALS, COMPARISON WITH SINTERED CERAMICS

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9.7 cm

$Y_3Al_5O_{12}$ (YAG) single crystal doped with vanadium ions (V^{3+}) is one of the few known materials, which show a nonlinear absorption effect. Such materials are especially attractive for Q-switching operation to obtain high peak power optical pulses. Single crystals of YAG: V were grown with use of the Czochralski method. A charge material was prepared on base of high purity oxides: Y_2O_3 (5.0N), Al_2O_3 (5.0N) and V_2O_5 (4.5N) as a dopant. The concentration of V^{5+} ions was 0.80 at.%.
Recently the YAG ceramics were synthesized to replace the YAG single crystals. These ceramics, which are characterized with similar to the YAG single crystals optical properties, were obtained to increase the doping range, simplify technological process and lower costs.
X-ray photoelectron spectroscopy was used to study the chemical composition and electronic structure of the YAG: V single crystals. The XPS spectra of YAG: V^{3+} annealed in reducing atmospheres: H_2, vacuum and vacuum + H_2 are presented and discussed. For comparison the ceramics were investigated. The XPS showed the dopant concentration of V^{3+} is lower than a nominal one. The aluminium deficiency and yttrium excess for the all measured samples was found. The chemical shift analysis confirmed more ionic bond of Y-O than Al-O.

13.4 cm

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