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ELECTRON STRUCTURE AND OPTICAL PROPERTICS OF $Gd_3Ga_5O_{12}$ GARNET DOPED WITH Tb

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Rare-earth doped gadolinium gallium garnet ($Gd_3Ga_5O_{12}$) has attracted much attention as important material for application in many optical devices. Recently, the nanostructure materials are considered as potentially useful for many technological applications. This paper presents the results of electron structure and spectral-luminescent properties of pure and Tb^{3+} doped $Gd_3Ga_5O_{12}$ nanopowders prepared by a co-precipitation method. Analysis of diffractograms of the nanopowders showed that the minimum calcinations temperature that allowed getting a single garnet phase is T ~ 750^{o}C. An average crystalline size of powders is about 35-47 nm. The surface microstructure was observed by using an atomic force microscope Solver P47H-PRO. The luminescence transition $^5D_4 \rightarrow {}^7F_j$ (green emission) is dominated at the X-ray and photo excitation of nanosized $Gd_3Ga_5O_{12}$ doped with Tb^{3+}. The influence of the crystalline size and preparing condition on the luminescence properties of $Gd_3Ga_5O_{12}$ is discussed. High-energy spectroscopy has been used to study the electron structure of the investigated rare-earth doped gadolinium gallium garnet ($Gd_3Ga_5O_{12}$). The calculations of electron energy bands E(k) and partial DOS for compounds were performed by the semi relativistic linear muffin-tin orbital method without considerations of spin-orbit interactions. Effective filling numbers of electrons in different bands of components in garnet $Gd_3Ga_5O_{12}$ been calculated. Between the experimental and calculated X-ray emission spectra garnet $Gd_3Ga_5O_{12}$ good agreement has been obtained.