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# Up-conversion luminescence in samarium doped $\text{ZnAl}_2\text{Se}_4$ single crystals

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## Abstract

Photoluminescence spectra of  $\text{ZnAl}_2\text{Se}_4:\text{Sm}^{2+}$  due to the processes of charge carriers recombination from levels  $^5\text{D}_j$ ,  $^5\text{L}_j$ ,  $^5\text{G}_j$  and  $^5\text{H}_j$  ( $4f^55d^1$ ) on levels  $^7\text{F}_j$  of samarium ions were investigated. The broad photoluminescence band at energies 1.6–1.9 eV due to optical transitions of electrons from 4f shell to 1s of samarium ions level was discovered. Emitted energy of it was absorbed by transitions from  $^7\text{F}_j$  to  $^5\text{D}_j$  levels. An up-conversion process—electron excitation from  $^7\text{F}_j$  levels to  $^5\text{D}_0$ ,  $^5\text{D}_1$ ,  $^5\text{D}_2$  levels with simultaneous electron transitions to higher energy states  $^5\text{D}_3$ ,  $^5\text{D}_4$ ,  $^5\text{L}_j$ ,  $^5\text{G}_j$ ,  $^5\text{H}_j$  with subsequent recombination to  $^7\text{F}_j$  levels with energy emission in short-wavelength region were found out and investigated.