

# CHEMISTRY AND CHEMICAL TECHNOLOGY

2025

Student Scientific Conference

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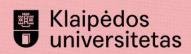
May 9, 2025 NFTMC, Saulėtekio al. 3, Vilnius

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ISSN 2538-7332 (digital), DOI https://doi.org/10.15388/CCT.2025









## LUMINESCENCE PROPERTIES OF CHROMIUM DOPED YAG AND YLuAG: INFLUENCE OF Cr<sup>3+</sup> CONCENTRATION

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Yttrium aluminium garnet (YAG) and yttrium lutetium aluminium garnet (YLuAG) are synthetic materials that belong to the garnet group. Synthetic garnet was first discovered in the 1950s, and since then the electronics industry has seen a rapid development of technologies using synthetic compounds with a garnet structure. YAG and YLuAG have good mechanical and optical properties. This matrix allows incorporation in solid solution of luminescent ions such as transition metals (Cr³+). Chromium doped YAG and YLuAG have different luminescence properties due to their structural differences and effect on crystal field, they are both widely used in luminescent systems. YAG is an excellent host for high power solid-state lasers due to its high density, high thermal stability, relatively efficient luminescence processes and high quantum efficiency. YLuAG, on the other hand, is often used in phosphor-converted LEDs and scintillators due to its great optical properties. However, garnets doped with different amounts of chromium show different results in luminescence properties. The measurements showed that even a small amounts of chromium incorporated in garnets indicate luminescent properties such as emission in NIR region, which is highly significant for applications in NIR-LED construction, horticulture and theranostics. This enables excellent results in luminescence with only a small amount of Cr³+.

In the present work, garnets doped with different amounts of chromium have been synthesised and their structural and luminescence properties were studied. Cr³+ doped YAG and YLuAG were synthesized by the sol-gel method. The phase purity of the samples was analysed by means of X-ray diffraction. The morphology of the compounds was evaluated by using scanning electron microscopy. Elemental analysis was carried out using inductively coupled plasma optical emission spectrometry. Photoluminescence properties such as emission and excitation spectra, decay curves, quantum efficiency have been investigated.