Optical properties of $Cs_2NaInCl_6:Cr^{3+}$ for application in pc-LED infrared emitters

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In recent years, the materials development community has devoted considerable attention to the broad class of materials known as perovskites, notable for their distinctive crystal structure. To date, the perovskite-structured materials researched in both industry and academia have been primarily inorganic or hybrid organic-inorganic lead halides. These materials are highly promising for applications in the photovoltaic and lighting industries, such as light-emitting quantum dots. However, their potential is significantly limited by the presence of toxic elements, as well as their poor mechanical strength and chemical stability.

Another emerging class of perovskite materials, free of many of the aforementioned disadvantages, is the halide double perovskites. These materials hold great potential for use in the photonics industry due to their favorable optical properties, including a direct bandgap and efficient excitonic emission. Additionally, these materials can be doped with lanthanides or transition metals, further enhancing their potential applications.

In this study, we present the optical properties of $Cs_2NaInCl_6:Cr^{3+}$ synthesized using the hydrothermal method. The material exhibits broadband and efficient emission in the near-infrared range around 950 nm when excited by ultraviolet light around 325 nm, visible light around 560 nm, or near-infrared light around 800 nm. The research focused on determining the spectroscopic properties of $Cs_2NaInCl_6:Cr^{3+}$, including the temperature dependence of luminescence intensity and decay time. Additionally, the study examined show luminescence emission and excitation spectra vary with pressure.
The investigated compound is suitable for use in phosphor-converted infrared LEDs (pc-LEDs), where the phosphor emits broadband infrared light when excited by a LED, typically InGaN. Such infrared emitters offer a promising alternative to traditional infrared LEDs based on InGaAs or GaAs and infrared light sources like tungsten halogen lamps in many branches of industry.

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