Synthesis and blue-to-ultraviolet upconversion properties of new langbeinite-type phosphates

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Ultraviolet C (UVC) radiation has attracted significant attention due to its strong ability to damage DNA, leading to cell death, bacteriostatic effects, and viral inactivation [1]. These properties make it highly effective for sterilization and disinfection applications. In recent years, UVC LEDs have increasingly been used as radiation sources because of their long operational lifetime, low energy consumption, and compact size. However, their efficiency remains limited, which drives the search for alternative mechanisms for UVC generation. One promising approach is photon upconversion, a process in which the sequential absorption of two or more low-energy photons results in the emission of higher-energy radiation with a shorter wavelength, such as ultraviolet light [2]. For instance, Pr^{3+}-doped materials can emit UVC radiation under blue-light excitation via intermediate states such as ^3P_J or $^1D_2$. Although a wide variety of praseodymium-activated host matrices exhibiting upconversion have been reported, they have not yet achieved broad practical application. Therefore, current research efforts are primarily focused on improving existing materials and discovering new compounds.

This work is devoted to the synthesis of new langbeinite-type phosphates and the investigation of their luminescent and upconversion properties. The potential of these materials for practical applications will also be discussed.

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