ZINC SILICATE BASED MATERIALS: DESIGNING SYNTHESIS AND UNDERSTANDING PROPERTIES

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Zinc silicate (Zn_2SiO_4) is a promising material due to its unique physical, electrical, and luminescent properties, and is used in various applications such as UV detectors, gas sensors, toxic ion adsorption, and optoelectronic devices [1]. Zn_2SiO_4 is commonly used as a host for rare earth and transition metal ions that emit light in the ultraviolet, visible, or infrared ranges. However, the lack of a deep understanding of the emission mechanism of undoped Zn_2SiO_4 is a limiting factor for a wider exploitation of the beneficial properties of the material. In this study, we have prepared zinc silicate powders through three different methods: solid-state, sol-gel, and molten salt methods, to examine the influence of the synthesis method on the structural, microstructural, and optical properties of the final product in order to gain a thorough understanding of zinc silicate emission. We have evaluated the structural and microstructural properties of the resulting powders using XRD, Raman, and SEM techniques. We have also conducted luminescence examinations using cathodoluminescence measurements at cryogenic and room temperatures.

Our research has shown that the synthesis method significantly affects the crystal structure, morphology, and optical properties of zinc silicate powders. The results have indicated that the sol-gel method is a highly effective in stabilizing the metastable β-Zn_2SiO_4 phase, while the molten salt method enables the formation of α-Zn_2SiO_4 at a lower temperature as compared to other methods. On the other hand, the solid-state reaction method requires a higher temperature to produce a single-phase α-Zn_2SiO_4. Luminescence measurements showed emission in the UV to visible range. This work provides new insights into the optimization of undoped Zn_2SiO_4 for various applications.

References

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