

EVOLUTION OF YTTRIUM SILICATE PHASES IN HYDROTHERMAL SYNTHESIS ROUTE

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Abstract

The current global pandemic underscores the imperative for the development of more effective strategies in antimicrobial treatments [1]. Optical materials that exhibit ultraviolet-C (UV-C) emission possess the potential as viable choices for these applications. $Y_2SiO_5:Pr^{3+}$ is regarded as one of the extensively investigated silicates exhibiting visible-to-ultraviolet upconversion emission [2]. The enhancement of UV emissions efficiency is a primary objective, and the focus of this study is to acquire and analyze various phases of silicate materials.

Several synthesis methods have been documented in scientific journals for the production of Yttrium silicates, including solid-state reaction, sol-gel method, and hydrothermal route. The primary obstacles encountered in their acquisition pertain to the polymorphism and numerous phases of the oxides [3]. This study aimed to explore a novel hydrothermal method for synthesizing yttrium disilicate. The synthesis process involved two primary starting materials: SiO_2 sol, which consisted of SiO_2 nanoparticles dispersed in ethanol, serving as the silicon source, and an aqueous solution of $Y(NO_3)_3 \cdot 6H_2O$, providing the yttrium source. These starting materials were combined in a stoichiometric Y/Si molar ratio of 1:1. In order to acquire yttrium disilicate, a series of procedures were undertaken, including the production of a mixture consisting of the initial ingredients, subjecting the mixture to hydrothermal treatment within an autoclave reactor, and subsequently conducting thermal treatment (calcination) of the precursors.

The parameters of hydrothermal treatment and calcination processes exhibit considerable variations in the primary and secondary phases detected through X-ray diffraction, as indicated by the obtained results. Hence, extended durations of synthesis reactions and calcination intervals resulted in the formation of a well-crystallized sample, whereby the predominant phase can be attributed to $Y_2Si_2O_7$.

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References

- [1] M. Raeiszadeh, B. Adeli, ACS Photonics 7(11) (2020) 2941.
- [2] S. L. Cates, E. L. Cates, M. Cho, J.-H. Kim, Environ. Sci. Technol. 48(4) (2014) 2290.
- [3] Z. Sun, M. Li, Y. Zhou, Int. Mater. Rev. 59 (7) (2014) 357.