

化学

## Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub>烧绿石的快速合成及其组织结构研究

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**摘要** 为探索Gd<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>烧绿石快速固化高放废物中锕系核素的新途径, 实验用高温高压固相反应法在3~4 GPa压力、1 573~1 673 K温度范围内合成了Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub>烧绿石固化体, 并利用X射线衍射仪、扫描电镜对样品进行了分析。结果表明: 高温高压固相反应法可在极短时间(15 min)内合成完全固溶的Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub>立方烧绿石固化体, 较常用制备方法(一般合成时间不低于48 h)快近200倍; 用该技术合成的样品在常温常压下的相转变温度及压力得以显著提高, 烧绿石相更趋稳定; 样品晶格常数随Nd含量的增加及合成温度的升高而逐渐增大, 随合成压力的增加而逐渐减小。这种快速高效的合成方法为未来开展高放核素的工业固化提供了一种新的技术途径和基本数据参考。

关键词 [Gd<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>烧绿石](#) [高温高压](#) [高放废物固化](#)

分类号

## Rapid Synthesis and Microstructural Characterization of Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub> Pyrochlore

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**Abstract** In order to explore a rapid synthesis method for Gd<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> pyrochlore immobilizing actinide elements from radioactive wastes, Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub> pyrochlore was synthesized via solid state reactions for 15 min under high pressure (3-4 GPa) and high temperature (1 573-1 673 K). The products were characterized by powder X-ray diffraction and scanning electron microscopy. The results indicate that among all the compositions, Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub> solid solution with a cubic pyrochlore structure is synthesized within only 15 min. This period is approximate 200 times faster than other common preparation methods with synthesis time of not less than 48 h. The phase transition pressure and temperature of the samples are expanded under high pressure and temperature conditions. The stability of the pyrochlore phase is found to increase. The lattice parameters of Gd<sub>1.6</sub>Nd<sub>0.4</sub>Zr<sub>2</sub>O<sub>7</sub> solid solutions gradually increase with the neodymium content and the synthesis temperature, and decrease with the increase of the synthesis pressure.

**Key words** [Gd<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> pyrochlore](#) [high temperature](#) [and](#) [high pressure](#) [high-level waste immobilization](#)

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