



材料合成及性能

NaYF₄: Yb³⁺, Er³⁺ 纳米粒子的上转换发光的温度特性

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摘要： 利用高温热溶剂法合成了NaYF₄:20%Yb³⁺,2%Er³⁺ 纳米粒子,通过X射线衍射谱、扫描电镜及低温荧光光谱对其结构、形貌及发光性质进行了表征。研究表明:合成的纳米粒子为六角相,粒径大小约30 nm。变温光谱研究表明:由于⁴S_{3/2}和²H_{11/2}能级差较小,当温度增加至45 K时⁴S_{3/2}能级和²H_{11/2}能级的电子布局同时相应地增加;而当温度超过45 K之后,温度依赖的²H_{11/2}能级布局随着温度的提高而增多,表现为520 nm的发光随着温度的提高一直增强。由于无辐射弛豫速率随温度升高而快速增加,导致545 nm的发光随着温度的提高先增强后减弱。

关键词： 稀土离子 NaYF₄: Yb³⁺, Er³⁺ 上转换发光 变温光谱

Temperature Dependence of Upconversion Luminescence in NaYF₄: Yb³⁺, Er³⁺ Nanoparticles

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Abstract: Uniform NaYF₄:20%Yb³⁺,2%Er³⁺ nanoparticles were synthesized *via* solvothermal method following high temperature. The X-ray diffraction (XRD) shows that the samples are β-NaYF₄ nanocrystals, and SEM images show that the nanoparticles have an average of 30 nm. The intensity of 520 nm emissions gradually increase with temperature rising from 13 K to 300 K, while the intensity of 545 nm emissions first increase and then decrease under 980 nm laser excitation. The reason for this phenomenon is that the electronic distribution of ²H_{11/2} is dependent on the temperature, while the emissions of ⁴S_{3/2} energy level is governed by a competition process between the thermal agitation and non-radiation decay.

Keywords: rare-earth ions NaYF₄: Yb³⁺, Er³⁺ upconversion luminescence spectrum at various temperatures

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