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材料合成及性能

Er^{3+}/Yb^{3+}共掺$KLaF_4$纳米晶的制备和上转换发光

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摘要： 用水热法成功制备了Er^{3+}/Yb^{3+}共掺不同浓度比的$KLaF_4$纳米晶,并在300℃氩气气氛下退火。利用X射线衍射谱(XRD)、透射电子显微镜(TEM)对样品的晶体结构和形貌进行了表征。测量了样品漫反射谱、980 nm 激发下的上转换发射光谱和$^2H_{11/2}$能级的荧光寿命。研究结果表明:制备得到的样品为六方相的纳米棒,退火后纳米棒平均直径为28 nm,长为130 nm;在Er^{3+}浓度一定的情况下,提高Yb^{3+}掺杂量有利于增强973 nm 附近光的吸收;980 nm 的近红外光可上转换为较强的绿光和红光,且红绿光强度和$^2H_{11/2}$能级的平均荧光寿命均会随着Yb^{3+}掺杂浓度的增加而下降。

关键词： 上转换性能 水热法 $KLaF_4$：Er^{3+},Yb^{3+}纳米棒

Preparation and Upconversion Luminescence of Er^{3+}/Yb^{3+} Codoped $KLaF_4$ Nanocrystals

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Abstract: $KLaF_4$ nanocrystals (NCs) co-doped with 2%Er^{3+}(fixed) and varied Yb^{3+} doping mole fractions (10%, 14%, 18%) were synthesized by hydrothermal method. The samples were annealed in argon at 300℃ for 1.5 h.The crystal structure and morphology of the samples were confirmed by X-ray diffraction (XRD) and transmission electron microscopy (TEM), respectively. The optical properties of the samples were evaluated by diffuse reflectance spectra and up-conversion photoluminescence spectroscopy with the average fluorescent lifetimes of $^2H_{11/2}$ level under laser excitation at 980 nm. The results show hexagonal $KLaF_4$: Er^{3+},Yb^{3+} NCs are successfully obtained, which have a longitude of about 130 nm and a diameter of 28 nm for the annealed sample. The diffuse reflection spectra indicate that the absorbtion at around 973 nm is enhanced with the increase of Yb^{3+} mole fraction while Er^{3+} mole fraction is fixed. The near-infrared light at 980 nm can be up-converted to green and red light. Furthermore, both the intensities of the red and green light and the average fluorescence lifetimes for $^2H_{11/2}$ level were decreased with the increase of Yb^{3+} ion concentration in $KLaF_4$: Er^{3+}, Yb^{3+} NCs. In addition, the effect of Yb^{3+} doping concertration on the intensity of up-conversion luminescence and the average fluorescence lifetimes for $^2H_{11/2}$ level were briefly clarified.

Keywords: up-conversion properties hydrothermal method $KLaF_4$: Er^{3+},Yb^{3+} nanorods
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