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## 论文

### 球形 $Y_2O_2S:Yb, Ho$ 上转换粒子的合成及其尺寸相关的发光机制研究

邢明铭, 曹望和, 冯威, 庞涛, 凌小翘

大连海事大学光电子技术研究所, 大连 116026

#### 摘要:

采用改进的均匀沉淀法结合固-气硫化工艺制备了一系列 $Y_2O_2S:Yb, Ho$ 上转换粒子. 利用X射线晶体衍射(XRD)和透射电子显微镜(TEM)对粒子的结构和形貌进行了表征, 并通过上转换发光光谱(UCL)和红外光谱(FTIR)研究了粒子的上转换发光性质. XRD和TEM结果表明, 所制备的样品均为单一的六方相结构, 且所有粒子均呈单分散和尺寸均一的球形, 其尺寸分别为40, 80和200 nm. 根据发光强度和激发功率间的对数关系曲线发现, 随着粒子尺寸的降低, 蓝光发射由三光子吸收过程转变为双光子吸收过程; 而绿光和红光发射虽然一直保持双光子吸收过程, 但其对数曲线斜率均随粒子尺寸的降低而逐渐增大. 对该材料的粒子尺寸与上转换发光机制的关系进行了讨论.

关键词: 上转换; 发光机制;  $Y_2O_2S:Yb, Ho$

### Preparation and Size-dependent Upconversion Luminescence Mechanism of $Y_2O_2S:Yb, Ho$ Nanoparticles

XING Ming-Ming, CAO Wang-He\*, FENG Wei, PANG Tao, LING Xiao-Qiao

Optoelectronic Technology Institute, Dalian Maritime University, Dalian 116026, China

#### Abstract:

A series of  $Y_2O_2S:Yb, Ho$  upconversion particles were prepared using an improved homogeneous precipitation method combined with a solid-gas sulfuration technology. The structure and morphology of particles were characterized by X-ray diffraction(XRD) and transmission electron microscope(TEM), and the upconversion luminescence(UCL) properties and mechanisms were studied by UCL spectra and FT-infrared spectra(FTIR). The results of XRD indicated that the prepared samples were pure hexagonal structure. TEM images showed the prepared particles were mono-dispersed with regular sphere shape and exhibited the narrow size distribution with average size of 40, 80 and 200 nm, respectively. According to the  $\ln-I_p - \ln-I_{UCL}$  plots of emission intensity as a function of excitation power, it was found that the blue emissions varied from three-photon absorption process to two-photon absorption process with decreasing particle size. For the green and red emissions, only the two-photon absorption process was observed, but the slope values of the  $\ln-I_p - \ln-I_{UCL}$  plot increased with decreasing particle size. The mechanism of the effects of particle size on the UCL properties was discussed.

Keywords: Upconversion; Luminescence mechanism;  $Y_2O_2S:Yb, Ho$

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通讯作者: 曹望和, 男, 教授, 博士生导师, 主要从事纳米材料、稀土发光和生物荧光探针方面的研究. E-mail:

whcao\_dl@126.com

作者简介:

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