

论文

Tm<sup>3+</sup>和Ho<sup>3+</sup>双掺氟锗酸盐玻璃的中红外发光性质

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摘要:

用高温熔融法制备了Tm<sup>3+</sup>和Ho<sup>3+</sup>离子双掺的65GeO<sub>2</sub>-12AlF<sub>3</sub>-10BaF<sub>2</sub>-8Li<sub>2</sub>O-5La<sub>2</sub>O<sub>3</sub>氟锗酸盐玻璃,应用Judd-Ofelt理论,获得了Ho<sup>3+</sup>离子的强度参量( $\Omega_2, \Omega_4, \Omega_6$ ),自发辐射跃迁几率 $A_r$ ,辐射寿命 $\tau$ 等光谱参量。根据McCumber理论,计算了玻璃中Tm<sup>3+</sup>和Ho<sup>3+</sup>离子的吸收截面 $\sigma_a$ 、受激发射截面 $\sigma_e$ 和增益光谱 $G(\lambda)$ 。在808nm激光二极管激发下,研究分析了Tm<sup>3+</sup>离子的交叉弛豫过程和Tm<sup>3+</sup>敏化Ho<sup>3+</sup>离子的2.0 $\mu$ m的红外发射光谱。结果表明,一定浓度Ho<sup>3+</sup>的共掺提高了Tm<sup>3+</sup>(<sup>3</sup>F<sub>4</sub>)→Ho<sup>3+</sup>(<sup>5</sup>I<sub>7</sub>)之间的能量转移效率,增强了~2.0 $\mu$ m的红外发光。

关键词: Tm<sup>3+</sup>,Ho<sup>3+</sup>双掺; 锗酸盐氟氧化物玻璃; 红外发射光谱; 能量转移

Mid-infrared Luminescence Properties of Tm<sup>3+</sup> and Ho<sup>3+</sup> Co-doped Fluorogermanate Glasses

Abstract:

Fluorogermanate glasses with the compositions of 65GeO<sub>2</sub>-12AlF<sub>3</sub>-10BaF<sub>2</sub>-8Li<sub>2</sub>O-5La<sub>2</sub>O<sub>3</sub> codoped with Tm<sup>3+</sup> and Ho<sup>3+</sup> ions were fabricated by conventional melting method. According to the Judd-Ofelt theory, the J-O strength parameters ( $\Omega_2, \Omega_4, \Omega_6$ ) of Ho<sup>3+</sup> were calculated, by which the radiative transition probabilities, fluorescence branching ratios and radiative lifetimes were obtained. According to McCumber theory, the absorption and emission cross-sections corresponding to the <sup>3</sup>H<sub>6</sub>→<sup>3</sup>F<sub>4</sub> of Tm<sup>3+</sup> and the <sup>5</sup>I<sub>8</sub>→<sup>5</sup>I<sub>7</sub> transitions of Ho<sup>3+</sup> (at 2.0 $\mu$ m) have been obtained and respective gain cross section spectra have been computed as a function of population inversion. With 808nm LD excitation, the cross-relaxation process of Tm<sup>3+</sup> and infrared emission spectra of Tm<sup>3+</sup> sensitized Ho<sup>3+</sup> ions were studied. The results indicated that the energy transfer efficient of Tm<sup>3+</sup>(<sup>3</sup>F<sub>4</sub>)→Ho<sup>3+</sup>(<sup>5</sup>I<sub>7</sub>) ions were enhanced and the infrared fluorescence intensity at ~2.0 $\mu$ m were increased as the Ho<sup>3+</sup> co-doped into glass .

Keywords: Tm<sup>3+</sup>, Ho<sup>3+</sup> doubly-doped

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