

### 1.3at%Nd:YAG透明陶瓷的制备及激光性能研究

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**摘要** 以高纯氧化物商业粉体为原料, 采用固相反应和真空烧结技术, 制备了高质量的1.3at%Nd:YAG透明陶瓷. 研究了室温下Nd:YAG透明陶瓷的显微结构、光谱及激光性能. 实验结果表明,

Nd:YAG透明陶瓷主要以穿晶方式断裂; 平均晶粒尺寸为15 $\mu\text{m}$ , 且分布均匀;

晶粒中和晶界处没有检测到杂质和气孔存在, 且成分一致, 无偏析现象. 退火后样品在激光波长

1064nm处的透过率高达82.4%; 主吸收峰位于808.6nm处, 峰值吸收系数为4.45 $\text{cm}^{-1}$ , 激光波长

1064nm处的吸收系数为0.11 $\text{cm}^{-1}$ ; 主荧光发射峰位于1064nm处, 半高宽为0.82nm, 荧光寿命为258 $\mu\text{s}$ .

用LD端面泵浦Nd:YAG陶瓷样品(泵浦源最大输出功率为1000mW), 获得了波长为1064nm的连续激光输出,

激光阈值约530mW, 斜率效率为23.2%, 最大泵浦吸收功率为731mW时, 最大输出功率为45mW.

**关键词** [Nd:YAG透明陶瓷](#) [显微结构](#) [光谱性能](#) [激光性能](#)

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### Fabrication and Laser Performance of 1.3at%Nd:YAG Transparent Ceramics

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**Abstract** High-quality 1.3at% neodymium-doped yttrium aluminum garnet (Nd:YAG) transparent ceramic was fabricated by a solid-state reaction method and vacuum sintering using high-purity  $\alpha\text{-Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$  and  $\text{Nd}_2\text{O}_3$  as raw materials with tetraethoxysilane (TEOS) as sintering aid. The microstructure, the spectral property and the laser performance of the prepared Nd:YAG ceramic were studied. It is found that the sample exhibits pore-free structure with average grain size of 15 $\mu\text{m}$ . There is no secondary phase in the grain boundary and grain. Transmittance of the sample after annealing reaches 82.4% at the laser wavelength of 1064nm. The highest absorption peak is centered at 808.6nm and the absorption coefficient is 4.45 $\text{cm}^{-1}$ . The peak absorption coefficient at laser wavelength of 1064nm is 0.11 $\text{cm}^{-1}$ . The FWHM of 1064nm main emission peak is 0.82nm, and the fluorescence lifetime is 258 $\mu\text{s}$ . A laser diode (808nm) was used as pump source whose maximum output was 1000mW, and end-pumped laser experiment was demonstrated on 1.3at% Nd:YAG ceramic. The sample for laser testing is  $\phi 16\text{mm} \times 2.8\text{mm}$  in dimension, mirror-polished on both sides and without coating. With 731mW of maximum absorbed pump power, laser output of 45mW is obtained with slope efficiency of 23.2%. The laser threshold is 530mW.

**Key words** [Nd:YAG transparent ceramic](#) [microstructure](#) [spectral property](#) [laser performance](#)

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