

掺钕钇铝石榴石透明陶瓷 (Nd:YAG)体视学研究

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摘要

采用低温燃烧法合成出掺钕钇铝石榴石(Nd:YAG)粉末, 经模压300MPa成型, 于1700℃真空烧结5h, 制备出尺寸 $\phi 9\text{mm} \times 1\text{mm}$ Nd:YAG透明陶瓷片. 对Nd:YAG透明陶瓷片进行光透过率、场发射—环境扫描电镜测量. 采用体视学原理与方法定量地研究了Nd:YAG透明陶瓷的微观结构参数和光透过率之间的关系. 研究表明: 尺寸 $\phi 9\text{mm} \times 1\text{mm}$ Nd:YAG透明陶瓷片在可见光波段光透过率约为45%, 在近红外光波段约为55%; 随着入射光波长的增加, 光透过率增加; 随着晶粒三维球当径(D_{3S})的增加, 光透过率增加, 当 D_{3S} 约为20 μm 时, Nd:YAG透明陶瓷光透过率接近单晶理论值; 随着晶粒以及单个晶粒平均比表面积的增加, 光透过率降低; 随着晶粒三维平均自由距离的增加, 光透过率降低.

关键词 [掺钕钇铝石榴石](#) [透明陶瓷](#) [体视学](#) [微观结构](#)

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Stereology Study of the Neodymium Doped Yttrium Aluminum Garnet (Nd:YAG) Transparent Ceramics

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Abstract The neodymium doped yttrium aluminum garnet (Nd:YAG) powders were synthesized by the low temperature combustion and the transparent ceramic disks with 9mm in diameter and 1mm in thickness were prepared by the vacuum sintering at 1700℃ for 5h after being 300MPa model pressing. The transparent ceramics were characterized by optical transmittance, field emission gun-environment scanning microscope and the study were carried out on the qualitative relationship between the optical transmittance and microstructure parameters using stereology theory and method. The results show that the optical transmittance of Nd:YAG transparent ceramics with 9mm in diameter and 1mm in thickness is about 45% in visible region and 55% in infrared region and increase with the incidence light wavelength increasing. The optical transmittance increases with three dimensionally corresponding diameter (D_{3S}) of grain climbing and reaches the theoretical value of single crystals when D_{3S} is 20 μm . The optical transmittance decreases with the grain and single grain mean specific area enhancing and mean free distance of grains adding.

Key words [neodymium doped yttrium aluminum garnet](#) [transparent ceramics](#) [stereology](#) [microstructureenddocument](#)

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