

络合作用对Sol-gel法制备Er³⁺掺杂TiO₂粉末光致发光特性影响

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摘要

以钛酸正丁酯为前驱体, 乙酰丙酮为络合剂, 分别在室温和70°C进行对前驱体改性的络合反应, 获得改性前驱体Ti(O-Bu)_{4-x}(AcAc)_x. 以异丙醇为溶剂, 采用溶胶-凝胶(sol-gel)法制备0.1~3.0mol% Er³⁺掺杂TiO₂粉末. 差热-热重(TG-DTA)分析结果表明, 由室温络合改性前驱体制备的粉末, 无定型到锐钛矿和锐钛矿到金红石的相变温度, 较由70°C络合改性前驱体制备的粉末均升高40°C. X射线衍射(XRD)分析表明, 700°C烧结, 室温络合所得掺0.1~3.0mol% Er³⁺:TiO₂粉末为单一锐钛矿结构, 70°C络合所得粉末为锐钛矿和少量金红石的混合相结构. 400~800°C烧结, 两种络合所得粉末均获得中心波长为1.53μm的多峰结构光致发光(PL)谱. 其中, 700°C烧结的粉末PL强度最强. 70°C络合较室温络合的粉末PL强度可提高3倍.

关键词 [Sol-gel法](#) [TiO₂](#) [光致发光](#) [络合改性](#)

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Effect of Chelation on PL Properties of Er³⁺-doped TiO₂ Powders Prepared by Sol-gel Method

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Abstract

0.1-3.0mol% Er³⁺-doped TiO₂ powders were prepared by the sol-gel method using the modified titanium (IV) n-butoxide [Ti(O-Bu)_{4-x}(AcAc)_x] as the precursor which is prepared by chelating reaction between Ti(O-Bu)₄ and acetylacetone (AcAc) at room temperature and 70°C, respectively. The preparation was performed by using iso-propyl (*i*-PrOH) as solvent with the addition of hydrated erbium nitrated [Er(NO₃)₃·5H₂O]. When the temperature of the chelating reaction increased from room temperature to 70°C, both phase transformation temperatures of 1mol% Er³⁺-doped TiO₂ xerogels from amorphous to anatase and anatase to rutile were decreased about 40°C. XRD analysis showed that, sintered at 700°C the phase structure for the TiO₂ powders prepared by using Ti(O-Bu)_{4-x}(AcAc)_x chelated at room temperature is anatase, while that for the TiO₂ powders chelated at 70°C is the mixture of anatase and rutile in small amount. The photoluminescence (PL) spectra centered at about 1.53nm with the form of multi-peak were obtained for the powders by chelating at the two temperature sintered in the temperature range of 400°C. For 1mol% Er³⁺-doped TiO₂ powders sintered at 700°C, the PL peak intensity at 1.53μm increased by a factor of 3 with increasing the chelating reaction temperature to 70°C.

Key words [sol-gel method](#) [TiO₂](#) [photoluminescence](#) [chelating reaction](#)

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