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Eu:Y_2O_3纳米晶的光谱特性与微结构

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【摘 要】 采用均相共沉淀法制备了不同粒径的Y_2O_3:Eu^{3+}和Y_2O_3粉体材料%根据红外光谱和荧光光谱,探讨了纳米Y_2O_3:Eu^{3+}粉体的微观结构与同质体微米材料相对变化.发现纳米粉体的Y(Eu)-O键吸收峰校正高度和面积随着颗粒的减小而减小,而对于同质微米材料却相反.分析认为Y(Eu)-O键红外吸收峰校正高度和面积由Y(Eu)-O键的平均键长和Y(Eu)-O键振动态的数目两个因素决定,对于微米粉Y(Eu)-O键长起主要作用.由于纳米粉体的比表面积随粒径的减少呈指数的增加,不饱和键和悬空键的数目随粒径减小而指数增加,Y(Eu)-O键振动态的数目起主要作用;计算了纳米粉体相对微米粉的跃迁强度参量Ω_t/Ω_t'值,发现Ω_2和Ω_4均增加,说明粉粒内部跃迁几率增加.纳米荧光粉比微米粉荧光强度减少的实验事实应是纳米粉粒表面效应引起的,与红外光谱实验的结果相符.

【关键词】 纳米粉体Y_2O_3；Eu^{3+}；红光谱；荧光谱
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Spectrum characteristic and local structures of nanocrysalline Y_2O_3:Eu^{3+}

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Abstract: Y_2O_3 Eu^{3+} nanocrystals with different grain sizes were prepared by the homogeneous precipitation technique. According to the change of the infrared absorption and fluorescence spectra of Y_2O_3: Eu^{3+} the nano??owder related to macro??owder, differences on the local structure are discussed. We found that the correction height and the area of the infrared absorption peak of the Y

(Eu)—O bond increase with the size of the nanocrystalline grain until the particle size exceeds 100 nm in the opposite way firstly. We analyse and consider that the correction height and area of the infrared absorption peak of the Y(Eu)—O bond relate with two factors, one being the average bond??engthand the other the number of the vibrating??unning states of the Y(Eu)—O bond. For powders of the micron scale, the average bond??engthof the Y(Eu)—O bond is leading. Because the proportion of the facade area increases exponentially with the decrease of the grain size for nanocrystals, the number of non??aturation and hanging bonds at the surface of the grain increases rapidly with the decrease of the grain size. The number of the oscillation states of Y(Eu)—O bond acts mostly in nanocrystal. The relative intensity parameters of the transition Ω_t/Ω_t' of the nanocrystals to the macro??rystals ware calculated. It is discovered that Ω_2 and Ω_4 of the nanocrystals increase to compare with the macrocrystals. This can bring on the increase of the transition probability within the grain. The experiment fact that fluorescence intensity of the nanocrystals decreases to compare with the macro??rystal is due to the surface effect which accords with the experiment of the infrared absorption spectrum.

Key words: Nanopowder Y_2O_3； Eu^{3+}； Infrared absorption spectra； Fluorescence spectra

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