高等学校化学学报 2009, 30(8) 1621-1624 DOI: ISSN: 0251-0790 CN: 22-1131/O6

论文

酸根离子掺杂对多孔阳极氧化铝光致发光特性的影响

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摘要:

采用电化学二次阳极氧化法分别在纯硫酸、纯草酸及硫酸-草酸混合电解液中制备了3个系列的多孔阳极氧化铝(AAO)样品, 考察了它们在250 nm光激发下的光致发光(PL)特性. 研究结果表明, 各系列AAO样品在350～450 nm波段范围内的PL谱形均完全相似, 具有相同的发光中心, 即氧空位缺陷态; 掺杂进入AAO样品的SO_4^{2-}和$C_2O_4^{2-}$分解形成的发光中心对应的光发射分别在288和328 nm附近; 对于硫酸-草酸混合电解液中生长的AAO样品, 其在328 nm附近的发光峰随着硫酸-草酸体积比的增大呈先增大后减少的变化, 而288 nm附近的发光峰却由基本消失到逐渐显现. 初步分析了该现象的成因.

关键词: 多孔阳极氧化铝; 光致发光; 能量转移

Influence of Acid Radical Ions upon Photoluminescence Properties of Anodic Aluminum Oxide

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Abstract:

Photoluminescence(PL) properties of anodic aluminum oxide(AAO) membranes with an ordered nanopore array formed in a mixture of sulfuric acid and oxalic acid solution with various volume ratios by two-step anodizing process were investigated under an excitation at 250 nm. Measurements reveal that the PL band in the wavelength range of 350—450 nm originates from optical transitions from oxygen vacancies, the 288 nm and 328 nm peaks attribute to the impurities of SO_4^{2-} and $C2O_4^{2-}$ in AAO, respectively. With the increasing ratio of SO_4^{2-} vs. $C_2O_4^{2-}$, the intensity of 328 nm peak reaches a maximum value and then decreases, but the peak located at 288 nm vanishes nearly, then appears gradually. Analyse suggests that there is likely to be nonradiative energy transfer between the two kinds of PL centers originated from SO_4^{2-} and $C_2O_4^{2-}$. An energy transfer mechanism was proposed to explain the behaviors of the emission at 328 nm, and it was tentatively suggested by the PL properties of AAO membranes with dual-layered structure fabricated from sulfuric acid and oxalic acid.

Keywords: Porous anodic alumimum oxide; Photoluminescence; Energy transfer

收稿日期 2008-09-22 修回日期 网络版发布日期

DOI:

基金项目:

国家自然科学基金(批准号: 10774121)、甘肃省自然科学基金(批准号: 0803RJZA102)和西北师范大学三期“知识与科技创新工程”项目(批准号: NWNU-KJCXGC-03-22)资助.

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