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锰掺杂诱导正交相SnO_2的生长行为

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Growth Behavior of Orthorhombic SnO_2 Induced by Mn-Doped SnO_2

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摘要 通过一种简单的共沉淀方法制备了Mn 掺杂二氧化锡(SnO_2)颗粒, 对前驱体在不同温度下热处理, 并通过X 射线衍射(X-ray diffraction, XRD)和高分辨电子显微学(high-resolution transmission electron microscopy,HRTEM)对样品的微纳米结构进行了表征. 结果表明: 样品中除了四方相SnO_2 外, 还存在正交相SnO_2. XRD 测试结果显示, 随着退火温度的增加, 正交相SnO_2 的峰强减弱, 四方相的峰强增加. HRTEM 分析表明: 样品中可以同时找到四方相和正交相SnO_2的晶格像, 进一步证实了正交相SnO_2的存在. Mn 掺杂SnO_2 后, Mn 离子进入SnO_2晶胞, 替代了Sn 离子, 因此引起晶格扭曲畸变, 对正交相SnO_2的形成起着重要的作用.

关键词: 二氧化锡(SnO_2) 四方相 正交相 晶格畸变 微纳米结构

Abstract: Tin dioxide (SnO_2) is an n-type semiconductor material with tetragonal rutile crystal structure under normal conditions and displays many interesting physical and chemical properties. Another form of SnO_2 with an orthorhombic crystal structure is known to be stable only at high pressures and temperatures. However, there are limited reports on effects of Mn-doped tetragonal phase SnO_2 on micro/nanostructured characteristics. In this article, micro/nanostructures of Mn-doped tetragonal phase SnO_2 have been successfully prepared with a chemical co-precipitation method. The micro/nanostructural evolution of Mn-doped tetragonal phase SnO_2 under different heat treatment temperatures is evaluated with X-ray diffraction (XRD) and a high-resolution transmission electron microscopy (HRTEM). It is surprisingly found that the orthorhombic phase SnO_2 is formed in Mn-doped tetragonal phase SnO_2 . The obvious diffraction peaks and clear lattice fringes confirm that the orthorhombic phase SnO_2 nanocrystals evidently exist in Mn-doped SnO_2 samples. Experimental results indicate that the XRD peak intensities and crystal planes of the orthorhombic phase SnO_2 decrease with increasing of heat treatment temperatures. Formation of orthorhombic phase SnO_2 is attributed to the lattice distortion of tetragonal phase SnO_2 due to the Mn-doped tetragonal phase SnO_2.

Keywords: tin dioxide (SnO_2), tetragonal, orthorhombic, lattice distortion, micro-nanostructure

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