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研究论文

分级氧化铟纳米结构的同质外延生长及发光性能

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摘要: 用无催化碳热还原法合成了大量三维分级的In₂O₃亚微/纳米结构,用XRD、SEM、TEM和EDS等手段对In₂O₃纳米棒的形貌、成分和结构进行了表征。结果表明: In₂O₃纳米棒为具有体心立方结构单晶,沿着<100>和<111>方向外延生长,属于自组装和气固外延生长机制。同质外延生长的分级结构是“二次成核”和气固生长协同作用造成的。In₂O₃纳米棒的室温光致发光的发光峰位于386和435 nm,属于紫外发光和蓝光发光,分别起源于近带边发射和光生空穴与占据单离子氧空位的电子之间的复合。

关键词: 无机非金属材料 氧化铟 纳米结构 分级 同质外延

Homoepitaxial Growth and Photoluminescence Properties of Hierarchical In₂O₃ Nanostructures

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Abstract: Large-scale hierarchical In₂O₃ nanostructures have been synthesized using vapor transport and condensation method without any catalyst, taking advantage of the self-assembly property and epitaxial vapor-solid (VS) growth mechanism, and were characterized by X-ray diffraction, scanning electron microscopy, and transmission electron microscopy. The results show that the In₂O₃ nanorods are single crystals with body-centered cubic (bcc) structure, epitaxially growing along <100> and <111> directions. Homoepitaxial interconnections can be observed at the branched junctions, and the growth process of the nanorods arrayed on the microcrystals is a combination of “secondary nucleation” and VS process. The room-temperature photoluminescence spectrum of In₂O₃ nanostructures exhibited ultraviolet emission at 386 nm and blue emission at 435 nm, which can be ascribed to the near-band-edge (NBE) emission and the possible recombination of a photo-excited hole with an electron occupying the singly ionized oxygen vacancies, respectively.

Keywords: inorganic non-metallic materials In₂O₃ nanostructure hierarchical homoepitaxial

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