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材料化学工程与纳米技术

水合硼酸锶纳米超结构的制备与表征

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摘要

采用液相沉淀法，以氯化锶和硼酸氢铵为原料，制备了由纳米片组成的水合硼酸锶（$SrB_6O_{10}\cdot 5H_2O$）花状、枣状纳米超结构，并利用SEM、TEM、XRD进行了表征。化学分析及XRD结果表明，产物为单一$SrB_6O_{10}\cdot 5H_2O$相，纯度为99.5%。通过研究产物形貌结构随反应时间的演变过程，提出了水合硼酸锶纳米超结构的形成机理：反应初期晶核球形团聚，在此基础上晶核各向异性生长成片状结构，最终形成由纳米片组成的枣状或花状超结构。此外，研究了反应温度、反应物浓度等反应条件对产物形貌的影响。反应温度的升高使得纳米片尺寸增大，形状由不规则片状向矩形片状演变；团聚的有序度增加，产物形貌由无规则团聚体逐步演变为花状、枣状超结构。反应物浓度的降低，团聚体的有序度减小，产物中出现不规则团聚微球。

关键词

硼酸锶 超结构 液相沉淀 形成机理

分类号

Preparation and characterization of hydrated strontium borate superstructure

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Abstract

$SrB_6O_{10}\cdot 5H_2O$ flower-like and jujube-like superstructures consisting of nanoplates were prepared by a facile solution route，in which $NH_4HB_4O_7\cdot 3H_2O$ and $SrCl_2\cdot 6H_2O$ were used as raw materials and the liquid precipitation method was adopted. The superstructures were characterized by SEM，TEM and XRD. The results of XRD and chemical analysis indicated that the products were single phase $SrB_6O_{10}\cdot 5H_2O$ and the purity was 99.5%. Experiments were carried out to investigate the growth mechanism of the flower-like structures with the assistance of the TEM and SEM analysis. The mechanism of spherical aggregation of the $SrB_6O_{10}\cdot 5H_2O$ nuclei followed by the strong anisotropic 2D crystal growth was proposed. The effects of reaction temperature and reactants concentrations were also studied. It was found that the sizes of the aggregates and nanoplates increased with the elevating of temperature. The structure of samples transformed from disordered aggregations into flower-like and jujube-like superstructures，and the temperature of 70℃ was a crucial point for the change of substructure nanoplates from irregular shape to rectangular shape，and from disordered aggregation to ordered aggregation. With a lower concentration of the strontium reactant，the degree of orderliness decreased and the aggregates consisting of disorderly arranged nanoplates were observed.

Key words

strontium borate superstructure liquid precipitation growth mechanism

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