



CaCO₃纳米微粒的层状液晶模板法制备及其生长过程中的形貌演变

Calcium Carbonate Nanoparticles Prepared by Lamellar Liquid Crystal as Template and Shape Evolution during Growth

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中文关键词: 层状液晶; 碳酸钙; 纳米粒子; 纳米带

英文关键词: lamellar liquid crystal; calcium carbonate; nanoparticles; nanoshuttles; nanobelts

基金项目:

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中文摘要:

在Triton X-100/*n*-C₁₀H₂₁OH/H₂O体系中, 低角X射线衍射测试表明层状液晶的溶剂层厚度小于3 nm。利用层状液晶为模板制备了CaCO₃纳米微粒, 并用透射电子显微镜(TEM)、X射线衍射(XRD)和选区电子衍射(SAED)进行了表征。TEM结果表明所得CaCO₃纳米粒子的形貌为球形, 粒径在2~8 nm, 分布较窄。XRD表明CaCO₃纳米微粒的物相为方解石型和球霏石型混合结构。在制备过程中, Ca(OH)₂的加入和CaCO₃纳米微粒的析出并未破坏层状液晶的对称性和长程有序性。此外, 在Triton X-100/CH₃CH₂OH体系中, 研究了CaCO₃纳米微粒的生长行为, 发现小的纳米微粒先通过导向聚集生长成小的梭状物, 然后小的梭状物继续生长, 最后发生Ostwald陈化形成较为均一的两头尖的带状纳米结构, 其宽度在50~200 nm, 长度约为2 μm。

英文摘要:

Low angle X-ray diffraction results indicate that the thickness of the solvent layer of the lamellar liquid crystal in Triton X-100/*n*-C₁₀H₂₁OH/H₂O system is less than 3 nm. Based on the confinement of the thickness of the solvent layer, calcium carbonate nanoparticles (NPs) were prepared by replacing water with the saturated Ca(OH)₂ aqueous solution. The morphology of the obtained CaCO₃ NPs was spherical and their diameters were 2~8 nm with relatively narrow size distribution. Experimental results demonstrate that the addition of Ca(OH)₂ and the precipitation of the CaCO₃ NPs does not destroy the symmetry and long-range ordering of the lamellar liquid crystal. Furthermore, the growth behavior of the CaCO₃ NPs was studied in the Triton X-100/CH₃CH₂OH system. Corresponding morphology evaluation of the NPs was observed by TEM. The small nanoshuttles were formed through the oriented aggregation of the small NPs. Then, the small nanoshuttles gradually grow larger with duration time. Finally, uniform CaCO₃ nanobelts were obtained after one year. The width of the nanobelts was 50~200 nm and the length of them was above 2 μm.

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