

研究论文

硝酸盐制备三维有序大孔金属氧化物材料研究

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摘要 用硝酸盐、柠檬酸和乙醇/水按一定摩尔比配置成前驱物溶液, 采用胶晶模板法, 制备了三维有序大孔金属氧化物材料: Al_2O_3 , CeO_2 , Cr_2O_3 , NiO , MgO , In_2O_3 , $\text{CeO}_2/\text{Al}_2\text{O}_3$, $\text{Cr}_2\text{O}_3/\text{Al}_2\text{O}_3$ 和 $\text{NiO}/\text{Al}_2\text{O}_3$. SEM观察表明, 材料中大孔有序排列, 大孔间由小孔相连, 形成三维规则的笼状网络结构. XRD和TEM测试表明, 大孔孔壁由具有纳米尺寸的金属氧化物粒子组成. 实验表明, 加入乙醇、柠檬酸, 提高溶液对胶球润湿性, 改善溶液渗透能力, 避免粒子团聚, 有利于有序大孔结构的形成. 这一研究表明, 根据硝酸盐的物理化学性质, 调整溶液组成, 选择合适的热处理温度, 能得到大孔排列有序、三维规整性好的大孔结构材料. 此法具有原料易得, 操作简单的特点, 是3DOM材料的一种新型高效制备路线.

关键词 [三维有序大孔](#) [硝酸盐](#) [金属氧化物](#) [PS微球](#)

分类号

Nitrate Route for Fabrication of Three-dimensionally Ordered Macroporous Metal Oxides

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Abstract Using nitrates as precursors, a series of three-dimensionally ordered macroporous (3DOM) materials, such as Al_2O_3 , CeO_2 , Cr_2O_3 , NiO , MgO , In_2O_3 , $\text{CeO}_2/\text{Al}_2\text{O}_3$, $\text{Cr}_2\text{O}_3/\text{Al}_2\text{O}_3$ and $\text{NiO}/\text{Al}_2\text{O}_3$, have been successfully fabricated. The role of alcohol and citric acid in the precursors has been described. Especially, the addition of citric acid may significantly improve the formation of 3DOM skeleton. SEM observation indicates that in the materials the macropores are arrayed highly periodically and connected each other by small windows, showing a super-cage morphology structure with diameter of several hundred nanometers. XRD and TEM determination show that walls consisted of the nanoparticles. The particle crystal size was increased along with increase of the calcination temperature, which can finally cause the destruction of the ordered macroporous structure at higher calcination temperature. This study indicates that the nitrate route to the preparation of 3DOM materials is a novel and convenient approach.

Key words [three-dimensionally ordered macropore](#) [nitrate](#) [metal oxide](#) [PS colloidal crystal](#)

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