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# 有序介孔氧化硅薄膜制备及其$TiO_2$组装

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摘要 采用正硅酸乙酯（TEOS）作硅源，分别以阳离子表面活性剂十六烷基三甲基溴化铵（CTAB）和两亲性三嵌段共聚物（$EO_{20}PO_{70}EO_{20}$）为模板剂，盐酸为催化剂，利用溶胶凝胶工艺（sol-gel），通过提拉法在常压下制备介孔氧化硅薄膜。XRD和TEM测试结果表明,介孔氧化硅薄膜具有高度有序性。分别以这两种薄膜为模板，通过向模板内压入$TiCl_4$液体，并用水解、高温热处理等方法，合成了直径为50~300 nm的纳米$TiO_2$纤维，并用SEM对其进行了表征。纳米$TiO_2$纤维并不能形成于未去除模板剂的薄膜或未镀膜的基底上。纳米$TiO_2$纤维的形貌可通过调节介孔氧化硅薄膜的孔径大小来控制。经200~600 ℃高温热处理后，纳米$TiO_2$纤维呈锐钛矿结构。随着热处理温度升高，纳米$TiO_2$纤维的晶化程度增加。

关键词 介孔氧化硅薄膜 模板 纳米$TiO_2$纤维

分类号



# Preparation and $TiO_2$ Assembly of Highly Ordered Mesoporous Silica Films

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**Abstract** The research concerns in the preparation and $TiO_2$ assembly of mesoporous silica films at ambient pressure by sol-gel technique. First, the silicate sol was prepared with the procursor acitetraehoxysilane(TEOS) and cationic surfactant hexadecyl trimethyl ammonium bromide(CTAB) or amphiphilic triblock copolymer（$EO_{20}PO_{70}EO_{20}$）as template dissolved in ethanol and catalyzed by hydrochloric acid. Then the film was obtained by dip coating, and both XRD patterns and TEM image indicate that the films are highly ordered. Finally, the $TiO_2$ nanofiber was prepared by impregnating a mesoporous silica film with $TiCl_4$ followed by hydrolysis in air and calcination at high temperature in the oven. The prepared $TiO_2$nanofiber diameter is in the range of 50~300 nm and it was characterized by SEM. $TiO_2$ nanofibers can’t be formed on film containting template or bare substrate. $TiO_2$ nanofiber morphology can be varied by controlling the pore size of the mesoporous silica film. $TiO_2$ nanofiber has anatase phase after heating at200~600 ℃and its crystallization increases with calcination temperature increasing.

**Key words** mesoporous silica film _ template _ nano $TiO_2$fiber

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