

不锈钢基体上TiO₂陶瓷膜的制备

Fabrication of TiO₂ ceramic membrane on stainless steel substrates

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中文摘要:

作者对不锈钢基体上TiO₂陶瓷膜的制备技术进行了探索。试验以304不锈钢片为基体, 采用溶胶-凝胶法在其表面制备TiO₂陶瓷膜层, 探讨了溶胶的浓度、pH值、黏合剂和烧结温度对TiO₂膜层形貌的影响, 并利用X射线衍射技术(XRD)研究了膜层的物相结构。结果表明, 添加1%的聚乙烯醇(PVA1750)黏合剂于浓度0.07M、pH2.0的溶胶中制得涂膜液, 用该涂膜液浸涂304不锈钢片, 干燥后于600℃烧结, 可以得到均匀的片状结构TiO₂陶瓷膜, 经XRD分析, 该膜层以金红石相为主, 另含少量锐钛矿相; 添加0.3%的甲基纤维素(MC)黏合剂于浓度0.07M的溶胶中, 用该溶胶浸涂304不锈钢片, 干燥后于700℃烧结, 得到纯金红石相的颗粒状TiO₂陶瓷膜层。添加两种不同黏合剂的溶胶均可在不锈钢表面形成连续的TiO₂陶瓷膜层, 但两者的添加量不同, 需要的烧结温度也不同, 所得的物相结构及形貌亦不同。两种不同形貌的片状及颗粒结构之间分别形成较为均匀的孔隙, 可以作为过滤时的截留孔。

英文摘要:

Metallic membranes were gradually used in filtration and separation because of their high strength compared with organic and inorganic membranes; however, less reports about their preparation technology were found. In this work, the fabrication technology was studied. Sol-Gel method was used to fabricate TiO₂ ceramic membranes on 304 stainless steel substrates (SUS). Some factors, such as concentration, pH value of the sol, binders and sintering temperature were explored. Two type binders (polyvinyl alcohol (PVA) and methyl cellulose (MC)) were used to prepare casting solutions. One casting solution marked as 1# was prepared by adding 1% PVA into 0.07M sol and adjusting its pH value to 2.0, the other marked as 2# was prepared by adding 0.3% MC into 0.07M sol, 304 SUS pieces were then dip-coated into the solutions. The dried pieces dip-coated into 1# solution were sintered at 600℃ and those dip-coated into 2# were sintered at 700℃. A flake-like morphology and a grain-like morphology were obtained, respectively. Besides, the XRD results showed that the anatase and rutile phase existed in the membrane with flake-like morphology and the pure rutile phase was obtained in the membrane with grain-like morphology. Both of the casting solutions were able to form continuous TiO₂ membranes on 304 SUS. The obtained two types of morphologies existed pores which can be used to filtrate. The results show that sol-gel method is a promising method to obtain membranes with pores on metal substrates.

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