

催化、动力学与反应器

热集成的贵金属催化多孔硅微反应器元件的制备

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摘要

用直流腐蚀的方法, 在HF溶液中用p型单晶硅 [p-Si (100)] 制备了单孔 $\phi 3 \mu\text{m} \times 2 \mu\text{m}$ 、总孔容积 0.0224 mm^3 的多孔硅母模。用浸入置换的方法在多孔硅上沉积了Ag、Au、Pd、Pt的催化晶粒层。用化学镀的方法在多孔硅母模上沉积了一层厚约 $15 \mu\text{m}$ 的Ni镀层, 然后用电镀的方法增厚至 $200 \mu\text{m}$, 并从多孔硅上超声剥离, 得到镍阳模。形貌显示, 催化晶粒层只在多孔硅的棱边上沉积, 不在孔洞中生长, 多孔硅在保持多孔形状的同时, 负载了一层贵金属催化剂, 可以用来制备集成催化功能的微反应器。镍阳模与多孔硅的结合面是一层带环隙的岛状颗粒, 可以用作微换热器。用此方法可以用简单、价廉的工艺制备适用性较广的热集成的贵金属催化微反应器元件。

关键词

[单晶硅](#) [多孔硅](#) [化学镀](#) [电镀](#) [微反应器](#) [微换热器](#) [分散式生产](#)

分类号

Preparation of porous silicon microreactor components integrated with microheater and noble metal catalyst

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Abstract

A porous silicon (PS) template with porous size of $\phi 3 \mu\text{m} \times 2 \mu\text{m}$ and total volume of 0.0224 mm^3 fabricated by anodizing p-Si (100) in HF bath was reported. The seed layer catalysts of Ag, Au, Pd and Pt were formed by immersing deposition on PS in the metal ion solutions. A Ni positive template with thickness of $15 \mu\text{m}$ was deposited electrolessly, and increased to $200 \mu\text{m}$ by electroplating. Then Ni positive template was peeled off from PS by ultrasonic after dipping in 10% HF solution for 10 min. Morphology study showed that the seed layers deposited preferentially on borders than in pores of PS and the PS maintained its shape, which could be used to fabricate microreactor with catalytic function. The interface between Ni template and PS presented many orbicular island grains and could be used to fabricate microheater. The results show that this process is a simple, inexpensive technology and can be used to fabricate microreactor combined with microheater.

Key words

[monocrystal silicon](#) [porous silicon](#) [electroless deposition](#) [electroplating](#) [microreactor](#) [microheater](#) [distributed production](#)

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