

研究论文

在泡沫碳化硅载体上自转化合成silicalite--1型沸石晶体

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摘要:

以泡沫碳化硅载体内的残余硅为硅源, 在泡沫碳化硅载体上自转化合成silicalite--1型沸石晶体. 用残余硅含量为16.7%的泡沫碳化硅作为载体, 可制备出负载均匀、耐热性好、抗热冲击、比表面积为 $36\text{ m}^2\text{g}^{-1}$ 的silicalite--1型沸石晶体/泡沫碳化硅复合材料. 研究了泡沫碳化硅载体的残余硅含量和水热合成溶液的组成等因素对沸石晶体的自转化合成及其形貌的影响. 结果表明, 泡沫碳化硅载体中的残余硅含量是影响沸石晶体层结晶的关键因素. 当载体中硅的含量过低时, 溶液中的硅酸根浓度过低, 不具备形成沸石晶体的条件; 而当载体中硅的含量过高时, 溶液中的硅酸根浓度过高, 沸石晶体优先在残余硅的表面形核, 随着这些硅的溶解, 在其上形成的沸石晶体也随之脱落. 增加模板剂的含量可促进沸石晶体形核, 从而使沸石晶体的尺寸变小.

关键词: 无机非金属材料 复合材料 自转化合成 泡沫碳化硅 silicalite--1型沸石晶体

Preparation of silicalite-1 coating on SiC foam ceramics by support self-transformation

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Abstract:

Silicalite-1 coating on SiC foam ceramic was prepared by support self-transformation method using the residual silicon as silicon source. Silicalite-1/SiC foam composite with a specific surface area of  $36\text{ m}^2\text{g}^{-1}$  and homogeneous coverage and good thermal mechanical stability and good heat shock stability was fabricated on the SiC foam supports with a residual silicon amount of 16.7%. The influences of residual silicon amount in the supports, synthesis time and composition of the synthesis solution on the loading and morphology of the zeolite layer were investigated. It is found that the residual silicon amount is the key parameter to zeolite crystallization. Zeolite nucleus can not form on the SiC foam ceramic supports with too low amount of residual silicon, but can form on the residual silicon first when the amount is too high, which will make the zeolite crystal detached from the support during the subsequent silicon dissolution. In addition, increasing the template concentration can promote zeolite nucleation and reduce the size of zeolite crystals.

Keywords: inorganic non-metallic materials composites support self-transformation SiC foam silicalite-1 zeolite

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参考文献:

- 1 J.Weitkamp, Zeolites and catalysis, Solid State Ionics, 131(1-2), 175(2000)
- 2 J.Coronas, J.Santamaria, The use of zeolite films in small-scale and micro-scale applications, Chemical Engineering Science, 59(22-23), 4879(2004)
- 3 J.E.Antia, R.Govind, Applications of binderless zeolite-coated monolithic reactors, Applied Catalysis A:

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General, 131(1), 107(1995)

4 M.V.Twigg, J.T.Richardson, Fundamentals and applications of structured ceramic foam catalysts, Industrial & Engineering Chemistry Research, 46(12), 4166(2007)

5 M.Lacroix, M.Lacroix, P.Nguyen, D.Schweich, C.Pham-Huu, S.Savin-Poncet, Pressure drop measurements and modeling on SiC foams, Chemical Engineering Science, 62(12), 3259(2007)

6 G.Incera Garrido, F.C.Patcas, S.Lang, B.Kraushaar-Czarnetzki, Mass transfer and pressure drop in ceramic foams: A description for different pore sizes and porosities, Chemical Engineering Science, 63(21), 5202(2008)

7 F.C.Patcas, G.I.Garrido, B.Kraushaar-Czarnetzki, CO oxidation over structured carriers: A comparison of ceramic foams, honeycombs and beads, Chemical Engineering Science, 62(15), 3984(2007)

8 F.C.Buciuman, B.Kraushaar-Czarnetzki, Preparation and characterization of ceramic foam supported nanocrystalline zeolite catalysts, Catalysis Today, 69(1-4), 337(2001)

9 G.B.F.Seijger, O.L.Oudshoorn, W.E.J.van Kooten, J.C.Jansen, H.van Bekkum, C.M.van den Bleek, H.P.A.Calis, In situ synthesis of binderless ZSM-5 zeolitic coatings on ceramic foam supports, Microporous and Mesoporous Materials, 39(1-2), 195(2000)

10 G.Win'ee, J.P.Tessonier, S.Rigolet, C.Marichal, M.J.Ledoux, C.Pham-Huu, Beta zeolite supported on a  $\beta$ -SiC foam monolith: A diffusionless catalyst for fixed-bed Friedel-Crafts reactions, Journal of Molecular Catalysis A: Chemical, 248(1-2), 113(2006)

11 M.Rauscher, T.Selvam, W.Schwieger, D.Freude, Hydrothermal transformation of porous glass granules into ZSM-5 granules, Microporous and Mesoporous Materials, 75(3), 195(2004)

12 A.Zampieri, S.Kullmann, T.Selvam, J.Bauer, W.Schwieger, H.Sieber, T.Fey, P.Greil, Bioinspired rattan-derived SiSiC/zeolite monoliths: Preparation and Characterisation, Microporous and Mesoporous Materials, 90(1-3), 162(2006)

13 Y.Y.Wang, G.Q.Jin, X.Y.Guo, Growth of ZSM-5 coating on biomorphic porous silicon carbide derived from durra, Microporous and Mesoporous Materials, 118(1-3), 302(2009)

14 W.We, X.M.Cao, C.Tian, J.S.Zhang, The influence of Si distribution and content on the thermoelectric properties of SiC foam ceramics, Microporous and Mesoporous Materials, 112(1-3), 521(2008)

15 J.M.Zamaro, M.A.Ulla, E.E.Mir'eo, Zeolite washcoating onto cordierite honeycomb reactors for environmental applications, Chemical Engineering Journal, 106(1), 25(2005)

16 H.Katsuki, S.Furuta, Formation of novel ZSM-5/porous mullite composite from sintered kaolin honeycomb by hydrothermal reaction, Journal of the American Ceramic Society, 83(5), 1093(2000)

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1. 刘汉强, 高汝伟, 韩广兵 .Fe<sub>3</sub>B基纳米复合永磁材料的微结构和性能[J]. 材料研究学报, 2003,17(4): 0-400
2. 杨振明, 张劲松, 曹小明, 李峰, 徐志军 .用柠檬酸溶胶-凝胶法制备三效催化剂[J]. 材料研究学报, 2003,17(4): 0-374
3. 冯+C3419奇, 巴恒静, 刘光明 .二级界面对水泥基材料孔结构和性能的影响[J]. 材料研究学报, 2003,17(5): 0-494
4. 陈岁元, 刘常升, 张雅静, 才庆魁 .激光辐照丙酮溶液中固体靶制备纳米碳粉[J]. 材料研究学报, 2003,17(5): 0-498
5. 张栋杰, 都有为 .Fe<sub>2</sub>O<sub>3</sub>对锌铁氧体隧道结构和磁性能的影响[J]. 材料研究学报, 2004,18(1): 34-
6. 付绍云, 李来风 .短纤维增强树脂基复合材料强度和模量的各向异性[J]. 材料研究学报, 2003,17(4): 0-414
7. 顾四朋, 侯立松, 赵启涛 .Sn掺杂Ge--Sb--Te相变薄膜的晶化特性[J]. 材料研究学报, 2004,18(2): 181-186
8. 容敏智, 章明秋, 梁海春, 曾汉民 .修饰纳米CdS/聚合物的界面相互作用与光学性能[J]. 材料研究学报, 2004,18(2): 130-138
9. 刘旭东, 曹小明, 张洪延, 张劲松 .三维连通网络碳化硅的电特性[J]. 材料研究学报, 2004,18(4): 365-372
10. 程光旭, 李志军, 戚东涛 .纤维增强聚合物基复合材料的疲劳损伤模型[J]. 材料研究学报, 2004,18(1): 25-

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