

含氟体系下高性能丝光沸石分子筛膜的制备及其性能

任秀秀, 杨建华^a, 陈赞, 杨兴宝, 鲁金明, 张艳, 王金渠^b

大连理工大学化工学院吸附与无机膜研究所, 辽宁大连 116012

REN Xiuxiu, YANG Jianhua^a, CHEN Zan, YANG Xingbao, LU Jinming, ZHANG Yan, WANG Jinqub

Institute of Adsorption and Inorganic Membrane, School of Chemical Engineering, Dalian University of Technology, Dalian 116012, Liaoning, China

- 摘要
- 参考文献
- 相关文章

Download: PDF (1591KB) HTML (1KB) Export: BibTeX or EndNote (RIS) Supporting Info

摘要 采用热涂-浸渍法在大孔 α - Al_2O_3 载体上形成薄且致密的晶种层, 然后在不添加有机模板剂的含氟条件下二次水热生长法制备了高性能丝光沸石分子筛膜, 考察了 NaF 含量、硅/铝比对丝光沸石分子筛膜形貌和性能的影响。将摩尔组成为 $6\text{Na}_2\text{O}:1.2\text{Al}_2\text{O}_3:30\text{SiO}_2:780\text{H}_2\text{O}:1.5\text{NaF}$ 条件下合成的丝光沸石分子筛膜用于渗透汽化分离 91.5% 乙醇/水体系, 在渗透汽化温度 70°C 、真空度为 400 Pa 条件下, 分离因子和通量分别达到了 6872 和 $0.51\text{ kg}/(\text{m}^2\cdot\text{h})$; 另外, 在分离异丙醇/水、乙酸/水体系时, 渗透侧水浓度达到了 100% (在色谱检测极限范围内), 该分离系数是目前报道的丝光沸石分子筛膜分离的最佳值, 并在乙酸浓度为 1 mol/L 的乙醇水溶液中表现出良好的耐酸性。该膜有望作为膜反应器在乙酸乙酯等酯类的生产中大大提高转化率。

关键词: 丝光沸石分子筛膜 渗透汽化 热涂-浸渍法 耐酸性 氟体系

Abstract: High performance mordenite zeolite membranes in fluoride media with organic-free template were prepared on macroporous α - Al_2O_3 tubes by secondary growth. The seeding method was used hot dip-coating and could form a thin and compact layer. The effects of NaF content and Si/Al ratio on the morphology and pervaporation properties of the as-synthesized membranes were studied. The prepared membranes with a molar composition $6\text{Na}_2\text{O}:1.2\text{Al}_2\text{O}_3:30\text{SiO}_2:780\text{H}_2\text{O}:1.5\text{NaF}$ for pervaporation experiments were carried out at 70°C and vacuum pressure 400 Pa in a 91.5% EtOH/ H_2O system. The results indicated that the separation factor reached 6872 with flux $0.51\text{ kg}/(\text{m}^2\cdot\text{h})$. The H_2O concentration of permeation side for pervaporation of IPA/ H_2O , acetic acid/ H_2O systems can reach 100% (limit in GC detection). The membranes almost keep high selectivity as before after acid test with 1 mol/L acetic acid in the $\text{H}_2\text{O}/\text{EtOH}$ system. The membranes may have potential applications as membrane reactors in acetic ether production with a higher transformation ratio.

Keywords: mordenite zeolite membrane, pervaporation, hot dip-coating, acid-resistance, fluoride route

收稿日期: 2012-04-18; 出版日期: 2012-07-19

引用本文:

任秀秀, 杨建华, 陈赞等. 含氟体系下高性能丝光沸石分子筛膜的制备及其性能[J] 催化学报, 2012, V33(9): 1558-1564

REN Xiu-Xiu, YANG Jian-Hua, CHEN Zan etc. Preparation and Performance of Mordenite Zeolite Membrane Using Fluoride Route[J] Chinese Journal of Catalysis, 2012, V33(9): 1558-1564

链接本文:

<http://www.chxb.cn/CN/10.3724/SP.J.1088.2012.20436> 或 <http://www.chxb.cn/CN/Y2012/V33/I9/1558>

- [1] 王金渠, 杨建华, 陈赞, 殷德宏. 膜科学与技术 (Wang J Q, Yang J H, Chen Z, Yin D H. Membr Sci Technol), 2011, 31(3): 118
- [2] Morigami Y, Kondo M, Abe J, Kita H, Okamoto K. Sep Purif Technol, 2001, 25: 251
- [3] Hasegawa Y, Nagase T, Kiyozumi Y, Hanaoka T, Mizu-kami F. J Membr Sci, 2010, 349: 189
- [4] Zhou H, Li Y Sh, Zhu G Q, Liu J, Yang W Sh. Sep Purif Technol, 2009, 65: 164
- [5] Tanaka K, Yoshikawa R, Ying C, Kita H, Okamoto K. Catal Today, 2001, 67: 121
- [6] 肖强, 李自运, 孙昕, 项寿鹤. 催化学报 (Xiao Q, Li Z Y, Sun X, Xiang Sh H. Chin J Catal), 2005, 26: 243
- [7] 刘俊龙, 薛会福, 黄秀敏, 吴培豪, 黄信灵, 刘尚斌, 申文杰. 催化学报 (Liu J L, Xue H F, Huang X M, Wu P H, Huang X L, Liu Sh B, Shen W J. Chin J Catal), 2010, 31: 729
- [8] Cora L, Thompson R W. Zolites, 1997, 18: 132
- [9] Huang A Sh, Lin Y Sh, Yang W Sh. J Membr Sci, 2004, 245: 41
- [10] Lin X, Kikuchi E, Matsukata M. Chem Commun, 2000: 957 

Service

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ Email Alert
- ▶ RSS

作者相关文章

- ▶ 任秀秀
- ▶ 杨建华
- ▶ 陈赞
- ▶ 杨兴宝
- ▶ 鲁金明
- ▶ 张艳
- ▶ 王金渠

- [11] Casado L, Mallada R, Téllez C, Coronas J, Menéndez M, Santamaría J. *J Membr Sci*, 2003, 216: 135
- [12] Sastre G, Fornes V, Corma A. *J Phys Chem B*, 2002, 106: 701
- [13] Kato M, Itabashi K, Matsumoto A, Kazuo T. *J Phy Chem B*, 2003, 107: 1788
- [14] Lu B W, Tsuda T, Sasaki H, Oumi Y, Itabashi K, Teranishi T, Sano T. *Chem Mater*, 2004, 16: 286
- [15] Arichia J, Louis B. *Cryst Growth Des*, 2008, 8: 3999
- [16] 张延凤, 许中强, 陈庆龄. *催化学报* (Zhang Y F, Xu Zh Q, Chen Q L. *Chin J Catal*), 2002, 23: 235
- [17] Sato K, Sugimoto K, Kyotani T, Shimotsuma N, Kurata T. *J Membr Sci*, 2011, 385-386: 20
- [18] Li X S, Kita H, Zhu H, Zhang Zh J, Tanak K. *J Membr Sci*, 2009, 339: 224
- [19] 陈祥树, 周荣飞, 胡娜, 胡中丽, 段龙乔 (Chen X Sh, Zhou R F, Hu N, Hu Zh L, Duan L Q). CN 200910186437.8. 2009
- [20] Chen Z, Li Y H, Yin D H, Song Y M, Ren X X, Lu J M, Yang J H, Wang J Q. *J Membr Sci*, 2012, (in press). DOI: org/10.1016/j.memsci.2012.04.030
- [21] Xiao W, Chen Z, Zhou L, Yang J H, Lu J M, Wang J Q. *Microporous Mesoporous Mater*, 2011, 142: 154
- [22] Louis B, Kiwi-Minsker L. *Microporous Mesoporous Mater*, 2004, 74: 171
- [23] 李宝宗, 徐文国, 裘式纶, 庞文琴, 徐如仁. *高等学校化学学报* (Li B Z, Xu W G, Qiu Sh L, Pang W Q, Xu R R. *Chem J Chin Univ*), 1998, 19: 930
- [1] 邹响¹, 董张法¹, 刘琨¹, 冯献社². 间歇反应器内醋酸丁酯酯化反应与渗透汽化集成过程的模型计算[J]. *催化学报*, 2010,26(8): 999-1005
- [2] 周汉; 李砚硕; 朱广奇; 刘杰; 林励吾; 杨维慎; 中国科学院研究生院; 北京 000. 微波合成a&b取向的T型分子筛膜及其在渗透汽化耦合酯化反应中的应用[J]. *催化学报*, 2008,29(7): 592-594
- [3] 李砚硕; 刘杰; 陈红亮; 杨维慎; 林励吾. 微波加热合成含有极少量非分子筛缺陷孔的LTA型分子筛膜[J]. *催化学报*, 2006,27(7): 544-546
- [4] 陈红亮; 李砚硕; 刘杰; 杨维慎*; 林励吾. 利用原位水热合成在二氧化硅陶瓷管上制备高性能的Silicalite-1分子筛膜[J]. *催化学报*, 2005,26(12): 1039-1041