高等学校化学学报 2008, 29(12) 2484-2488 DOI: ISSN: 0251-0790 CN: 22-1131/O6

论文

超疏水网状结构对水中气泡的转移作用

王景明1,2, 郑咏梅3, 江雷1

1. 中国科学院化学研究所分子科学中心, 2. 中国科学院研究生院, 北京 100190;3. 北京航空航天大学, 化学与环境学院, 北京100191

摘要：

通过一步浸泡法制得了超疏水网状结构. 采用环境扫描电镜(ESEM)、X光电子能谱(XPS)和傅里叶变换红外光谱(FTIR)分别对超疏水网状结构的微观形貌和化学组成进行了表征, 结果表明, 超疏水的网状结构是由连续排列的类菊花状结构堆积而成的, 组成花瓣的微簇是具有层状结构的Cu[CH3(CH2)12COO]2. 借助高速照相机研究了超疏水网状结构表面与水中气泡的相互作用行为规律, 发现该超疏水网状结构对水中气泡产生转移作用, 而亲水的网状结构则不具备该特性.

关键词： 气泡 超疏水 网状结构 排气

Bubble Transfer Effect of Superhydrophobic Mesh Structure in Water

WANG Jing-Ming1,2, ZHENG Yong-Mei3, JIANG Lei1*

1. Beijing National Laboratory for Molecular Sciences(BNLMS), Institute of Chemistry, Chinese Academy of Sciences, 2. Graduate School of Chinese Academy of Science, Beijing 100190, China; 3. School of Chemistry and Environment, Beijing University of Aeronautics and Astronautics, Beijing 100083, China

Abstract:

Gas/liquid separation is a fundamental process in many chemical or biological processes, especially for microfluidic systems, in which microchannel can impede or even stop liquid flowing. Recently, many researches are focused on bubble removal from where they form in order to avoid the above adverse effects occurring. However, the introduction of venting holes will cause the leakage of inner liquid. Superhydrophobic mesh structures can hold water droplets steadily, and its capability of leakage prevention is excellent for mesh with small size. Herein, microscaled and nanoscaled hierarchical structured copper mesh was fabricated by one-step solution-immersion process and it exhibited perfect superhydrophobicity. The component and morphology of the as-prepared sample were characterized by XPS, FTIR and ESEM. FTIR and XPS spectra demonstrate that the aggregates have a chemical composition of Cu[CH3(CH2)12COO]2. The ESEM images clearly show that clusters of continuous flowerlike architectures are formed on the copper mesh substrate. Then, bubble behavior on such special structures was investigated by high-speed camera. It is found that bubbles in water can easily vent out through the superhydrophobic copper mesh, while the case does not happen to hydrophilic copper mesh. These findings will provide a method in designing novel superhydrophobic materials in the near future, which may be developed into an effective degassing plate with bubble capture and distributed venting for microfluidic devices.

Keywords: Bubble Superhydrophobic Mesh structure Venting

收稿日期 2008-09-24 修回日期 1900-01-01 网络版发布日期

DOI:

基金项目:

通讯作者: 江雷

作者简介:

参考文献：

Atchariyawut S., Jiraratananon R., Wang R.. Separ. Purif. Tech.[J], 2008, 63(1): 15—22
Kang S. W., Lee D. H., Park J. H., et al.. J. Memb. Sci.[J], 2008, 322(2): 281—285
Chiao M., Lam K. B., Lin L.. Proc. IEEE Int. Conf. Micro Electro Mechanical Systems[C], Kyoto, 2003: 383—386
St ckelhuber K. W., Schulze H. J., Wenger A.. Chem. Eng. Technol.[J], 2001, 24(6): 624—628

St ckelhuber K. W., Radoev B., Wenger A., et al.. Langmuir[J], 2004, 20(1): 164—168
Fan X., Zhang Z., Li G., et al.. Chem. Eng. Sci.[J], 2004, 59(13): 2639—2645
Kralchevsky P. A.. Langmuir[J], 1996, 12(24): 5951—5955
Guenther A., Jhunjhunwala M., Schmidt M. A., et al.. Int. Conf. Micro Total Analysis Systems(μTAS)[C], Squaw Valley, CA, 2003: 465—468
LI Huan-Jun(李欢军), WANG Xian-Bao(王贤宝), SONG Yan-Lin(宋延林), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2001, 22(5): 759—761
ZHANG Ya-Nan(张亚南), XIA Fan(夏帆), WANG Nü(王女), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2007, 28(3): 568—570
Meng D. D., Kim C.. J. Proc. ASME Int. Mechanical Engineering Congress and Exposition, CD: IMECE[C], Anaheim, CA, 2004: 62182—62184
Feng L., Zhang Z. Y., Mai Z. L., et al.. Angew. Chem. Int. Ed.[J], 2004, 43(15): 2012—2014
Wang S., Song Y., Jiang L.. Nanotechnology[J], 2007, 18(1): 015103—015108
Song W. L., Xia F., Bai. Y. B., et al.. Langmiur[J], 2007, 23(1): 327—331
Meng D. D., Kim J., Kim C. J.. J. Micromech. Microeng.[J], 2006, 16(2): 419—424
Wang S., Feng L., Jiang L.. Adv. Mater.[J], 2006, 18(6): 767—770
Feng L., Li S., Li Y., et al.. Adv. Mater.[J], 2002, 14(24): 1857—1860
Jiang L., Zhao Y., Zhai J.. Angew. Chem. Int. Ed.[J], 2004, 43(33): 4338—4341

本刊中的类似文章

1．阴启明, 叶嘉明, 周勇亮.超亲疏水图案改善阵列芯片质量[J]. 高等学校化学学报, 2008,29(8): 1647-1649

2．王丽芳, 赵勇, 江雷, 王佛松.静电纺丝制备超疏水TiO_2纳米纤维网膜[J]. 高等学校化学学报, 2009,30(4): 731-734

文章评论

序号	时间	反馈人	邮箱	标题	内容