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采用溶剂抽提法制备3-巯丙基三甲氧基硅烷自组装单层膜

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摘要: 为提高硅烷自组装单层膜的质量, 提出溶剂抽提制备的工艺。玻片在 5×10^{-3} mol/L的巯基丙基三甲氧基硅烷(MPTS)苯溶液浸泡反应, 依次用苯、丙酮、双蒸水回流抽提, 得到MPTS的自组装膜。使用接触角、俄歇电子能谱及X射线光电子能谱等方法进行表征。研究表明: 在惰性气体保护下, 连续使用非极性溶剂和极性溶剂抽提, 有效清除玻璃表面硅烷的物理吸附层, 有效防止巯基硅烷的氧化, 获得膜厚度为0.8 nm、均匀的MPTS自组装单层膜。该工艺为制备稳定的硅烷自组装单层膜提供一种新方法。

关键字: 单层自组装; 多层自组装; 硅烷; 溶剂抽提

Self-assembled monolayers of 3-mercaptopropyltrimethoxysilane by solvent-extracting

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Abstract: A solvent-extracting technique was proposed to prepare self-assembled monolayers of silane with high quality. Self-assembly of mercaptopropyltrimethoxysilane (MPTS) on glass substrates was realized using immersion reaction of glass substrates in 5×10^{-3} mol/L of MPTS in benzene followed by solvent-extracting with benzene, acetone and double-distilled water. The obtained self-assembled monolayers were characterized with water contact angle goniometry, auger electron spectroscopy and X-ray photoelectron spectroscopy. The experimental results show that solvent-extractions with non-polar and polar solvents in inert gas atmosphere remove effectively the physisorbed silane molecules and inhibit effectively the oxidation of mercapto groups. As a result, a homogeneous MPTS self-assembled monolayer is obtained with the thickness of 0.8 nm. This technique provides a novel avenue for the production of stable self-assembled monolayers with silane.

Key words: self-assembled monolayers; self-assembled multilayers; silane; solvent-extracting

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