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论文

氢稀释对纳米晶硅薄膜晶化特性的影响及薄膜生长机理

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摘要:

以SiH_4与H_2作为前驱气体,采用射频等离子增强化学气相沉积技术制备了纳米晶硅薄膜.利用Raman散射和红外吸收光谱等技术,对不同氢稀释比条件下薄膜的微观结构和键合特性进行了研究.结果表明,随着氢稀释比增加,薄膜的晶化率明显提高,而氢稀释比过高时,薄膜晶化率呈现减少趋势.红外吸收光谱分析表明,纳米晶硅薄膜中氢的键合模式与薄膜的晶化特性密切相关.随着氢稀释比增加,薄膜中整体氢含量和SiH_2键合密度明显减少,而在高氢稀释比条件下,氢稀释比增加导致薄膜中SiH_2键合密度和整体氢含量增加.

关键词: 纳米晶硅薄膜 晶化率 氢稀释 生长机理

Effect of Hydrogen Dilution on the Crystallization Behavior of Nanocrystalline Silicon Films and Their Growth Mechanism

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Abstract:

Nanocrystalline silicon films were prepared by radio frequency plasma enhanced chemical vapor deposition (RF-PECVD) technique with SiH_4 and H_2 precursors. The micro-structure and the bonding characteristics of deposited films with different hydrogen dilution ratios were studied by Raman scattering spectroscopy and Fourier transform infrared absorption (FTIR) spectroscopy. The results show that with the increase of hydrogen dilution ratios, the thin film crystallization rate obviously improves to a certain extent, however, with the further increase, the film crystallization rate shows a downward trend. The analysis of infrared absorption spectra shows there is a close relationship between the silicon-hydrogen bonding model and the crystallization characteristics. With the continuous improvement of the hydrogen dilution ratios, the SiH_2 bond density and the total hydrogen content in the film reduce significantly. In conditions of high hydrogen dilution ratios, the intensification of dehydrogenation reaction lead to the SiH_2 bond density and the total hydrogen of film increases, and lead to a decline in the rate of film crystallization.

Keywords: Nanocrystalline silicon films Crystallization rate Hydrogen dilution Growth mechanism

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