

衬底温度对Si(111)衬底上MBE异质外延3C-SiC薄膜的影响

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摘要 利用固源分子束外延(SSMBE)技术, 在Si(111)衬底上异质外延生长3C-SiC单晶薄膜, 通过RHEED、XRD、AFM、XPS等实验方法研究了衬底温度对薄膜结构、形貌和化学组分的影响. 研究表明, 1000℃生长的样品具有好的结晶质量和单晶性. 在更高的衬底温度下生长, 会导致大的孔洞形成, 衬底和薄膜间大的热失配使降温过程中薄膜内形成更多位错, 从而使晶体质量变差. 在低衬底温度下生长, 由于偏离理想的化学配比也会导致薄膜的晶体质量降低.

关键词 [碳化硅薄膜](#) [硅衬底](#) [固源分子束外延](#) [衬底温度](#)

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Effects of Substrate Temperature on Heteroepitaxial Growth of 3C-SiC Thin Films by MBE on Si(111) Substrate

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Abstract Single crystalline 3C-SiC thin films were grown on Si(111) at different substrate temperatures by solid source molecular beam epitaxy (SSMBE). Their structure, morphology and chemical component and the influence of the substrate temperature were investigated by reflection high energy electron diffraction (RHEED), X-ray diffraction (XRD), atom force microscope (AFM) and X-ray photoelectron spectroscopy (XPS). The results indicate that the sample grown at substrate temperature of 1000℃ exhibits the best crystalline quality. For higher substrate temperature, there will be more huge voids on sample surfaces, and the large mismatch of thermal expansion coefficient between SiC and Si can cause more dislocation when samples are cooled down to room temperature from high substrate temperature. For lower substrate temperature, the deviation from stoichiometry will occur, which is responsible for the deteriorations of crystalline quality.

Key words [SiC thin films](#) [Si substrate](#) [solid source molecular beam epitaxy](#) [substrate temperature](#)

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