化学学报 1994 52 (2): 105-110 ISSN: 0567-7351 CN: 31-1320/06

角分辨飞行时间法研究**GaAs(100)**表面蚀刻反应动力学

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收稿日期 修回日期 网络版发布日期 接受日期

摘要 采用探测室可转动的分子束实验装置,研究了氯分子束与GaAs(100)表面热反应和紫外激光诱导反应的动力学.结果表明,热反应的主要产物为GaCl~3,其角分布可用cos^2^.^3θ函数拟合.对于紫外(355nm)激光诱导反应,由角分辨的飞行时间(TOF)法测得主要产物为GaCl等,它们的通量角分布须用双余弦加和公式(c~1cosθ+c~2cos^nθ)拟合,表示产物粒子在表面法线方向明显聚集,而且由TOF 谱求得粒子的动能在表面法线方向最大.这种明显的聚集现象可以由激光诱导的粒子在表面附近发生碰撞效应来解释

关键词 砷化镓 反应动力学 表面 分子束 刻蚀 激光诱导 飞行时间谱 四极质谱

分类号 0643

A kinetic study of chemical etching of GaAs(100) surface using angle-resolved TOF method

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Abstract A rotatable mass spectrometer coupled with a Cl2 supersonic mol. beam scattering technique is used to examine the fundamental processes involved in thermal reaction and 355 nm laser-induced chem. etching of the GaAs(100) surface with a Cl2 mol. beam. The results of the thermal reaction of the GaAs/Cl2 system show that GaCl3 is the main product and its angular distribution can be fit with cos2.3 Q function. For the UV laser-induced reaction, the main reaction products are GaCl and Ga. The time-of-flight (TOF) spectra of these reaction products are measured as a function of the scattering angle, laser fluence and incident angle of the chlorine beam. The measured flux angular distribution and desorbing GaCl can be fit satisfactory with a function of (c1cosQ + c2cosnQ). It implies that the desorbing products are strongly collected at the direction of the surface normal, the kinetic energies of products are peaked around this direction. These phenomena can be interpreted in terms of post-desorption collisions.

Key words GALLIUM ARSENIDE REACTION KINETICS SURFACES MOLECULAR BEAM ETCH LASER INDUCTION TIME OF FLIGHT SPECTRA

DOI:

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