

论文

测试原位纳米压痕的微型加载装置

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摘要:

提出一种用于原位纳米压痕测试的微型精密加载装置。结合纳米压痕测试的基本要求,对精密加载装置进行了结构设计分析,建立了以压电叠堆推动柔性铰链推进单晶金刚石工具头实现压痕测试的方案,依据胡克定律利用柔性铰链敏感单元实现对压入力信号的检测。对压入柔性铰链单元进行了力学分析和模态研究,在此基础上,对研制测试平台样机的压入特性、载荷力检测等进行了试验测试,并利用研制的样机对单晶硅晶片进行了压痕试验。加载装置在100 V驱动电压下压头有效行程可达11.96 μm,基本满足压痕测试的功能要求。

关键词: 原位纳米压痕 精密加载机构 力学信号 位移信号 金刚石压头

Micro type loading device for in situ nanoindentation test

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Abstract:

A kind of micro type precision loading device for in situ nanoindentation test was proposed. Assisting with the main requirement to nanoindentation test, the mechanism of precision loading device was designed and analyzed, and the scheme to realize nanoindentation test of diamond indenter under the help of hybrid process of piezoelectric stack and flexure hinges was established. The force signal of nanoindentation was measured via flexure hinge based on Hooke's law. The mechanical analysis and modal study of indentation flexure hinges unit were carried out. Based on those works, the indentation performance, loading force measurement and so on of developed testing platform were tested. The indentation test of single crystal silicon wafer was carried out with the developed prototype. The effective stroke of diamond indenter was 11.96 μm with actuating voltage of 100 V. The platform meets the basic functional requirements of indentation test.

Keywords: in situ nanoindentation precision loading device force signal displacement signal diamond indenter

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