基于辅助结构实时监测大高宽比纳米结构显影过程的方法研究

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摘　要：

提出了一种引入辅助结构作为显影过程的监测对象来实现对大高宽比纳米结构高度变化进行实时无损监测的方法。随着结构高度的变化，矩形光栅表现出明显的光学性质的变化，便于进行光学监测，适合用作辅助结构。使用光栅负一级和正一级衍射效率两个参数作为监测依据，首先通过观测它们的起伏变化得到结构大致的高度范围，然后通过观测负一级与正一级的比值得到结构高度的精确值，从而实现对大高宽比纳米结构高度的实时监测。以高度为3μm的纳米结构为例，设计了线密度为50 线/mm和160 线/mm的矩形光栅作为辅助结构来监测显影过程中结构高度的变化。模拟结果表明，通过监测光栅衍射效率的变化可以有效地监测纳米结构高度的变化，该方法适用于对大高宽比纳米结构的显影过程进行实时监测。

关键词：微机电系统，辅助结构，实时监测，大高宽比纳米结构，衍射效率

Real-time Monitoring the High-Aspect-Ratio Nanostructures in the Development by Using Auxiliary Structures

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Abstract:

In order to monitor the height of the high-aspect-ratio nanostructures (HARNST) in the development process, the auxiliary structures are introduced on the same substrate as the nanostructures. The rectangle gratings, which display a conveniently detected optical phenomenon with the variation of height, are appropriate to be the auxiliary structures. The -1st and +1st diffracted efficiency of the gratings are monitored in the development. The real-time monitoring of HARNST carried out by estimating height according to the ±1st diffracted efficiency and accurately measuring height with their ratios. The rectangle gratings with 50 lines/mm and 160 lines/mm are designed to be auxiliary structures for the monitoring of the HARNST with height up to 3μm. The simulation results show that it is effective to monitor the height of HARNST by monitoring the diffracted efficiency of the auxiliary grating. And this method has a universal application to various nanostructures.

Keywords: MEMS, auxiliary structure, real-time monitoring, high-aspect-ratio nanostructure, diffracted efficiency

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