

## 微型硅基弯曲板波器件

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摘要:

介绍了基于ZnO压电薄膜的微型弯曲板波(FPW)器件的设计与制作。为减小薄膜的应力,器件采用LTO/ZnO/LTO/Si3N4多层复合板结构,并采用直流磁控溅射制备ZnO压电薄膜,在压电复合板结构上沉积两对叉指电极,分别用于Lamb波的激发和接收。X射线衍射分析表明,沉积的ZnO薄膜是一个C轴高度择优的压电薄膜;扫描电子显微镜分析表明,制备的ZnO薄膜平整、致密,晶粒生长呈现明显的柱状结构;通过分析制备的高次谐波体声波谐振器(HBAR)器件性能来间接检验ZnO压电薄膜的电性能,HBAR器件的品质因子较高表明薄膜有良好的压电性能。利用安捷伦E5071C网络分析仪检测FPW器件的频率响应,结果表明,反对称A0模式的Lamb波的实测中心频率与理论计算的频率结果基本一致。

关键词: 弯曲板波; ZnO压电薄膜; 多层复合板; 叉指电极

## Si-substrated Micro-structural Flexural Plate Wave Devices

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**Abstract:**

The design and fabrication of micro-structural flexural plate wave (FPW) devices based on the ZnO piezoelectric film are introduced. To reduce the film stress, LTO / ZnO / LTO / Si3N4 multi-layer composite plate structure is adopted, DC magnetron sputtering is applied to deposit ZnO piezoelectric film, two pairs of interdigital electrodes are deposited on the piezoelectric composite plate structure, the interdigital electrodes are adopted for the lamb wave excitation and reception, respectively. X ray diffraction results show that the deposited ZnO film is highly preferred C axis piezoelectric film. The scanning electron microscopy shows that the prepared ZnO films are smooth, dense, and grain growth appears obvious columnar structure. The high harmonic bulk acoustic resonator (HBAR) device are prepared to investigate ZnO piezoelectric film electrical properties indirectly. The higher quality factor of HBAR device indicates the film has good piezoelectric properties. The FPW device frequency response is analyzed with the Agilent E5071C network analyzer. The results show the measured center frequency of the antisymmetric A0 modes lamb wave is basically identical with the theoretical calculation result.

**Keywords:** flexural plate wave; ZnO piezoelectric film; multi-layer composite plate; interdigital electrode

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