

平面电极型MEMS电化学地震传感器

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MEMS based electrochemical seismic sensors with planar electrodes

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摘要 图/表 参考文献 相关文章 (15)

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摘要 针对传统电化学地震传感器的加工工艺成本高、一致性差等问题,设计了一种新的平面电极型微机电系统(MEMS)电化学地震传感器结构。建立了平面电极型MEMS电化学地震传感器的计算模型,通过Comsol多场耦合数值模拟分析方法,对影响传感器的结构参数如:电极宽度、电极间距、流道高度等进行了计算和优化。采用MEMS表面工艺和准LIGA工艺,制备了平面电极型MEMS电化学地震传感器。最后,与采用传统方法精密加工的MET2003器件进行了频率响应和微震动的对比测试。实验结果表明:与MET2003器件相比,平面电极型MEMS电化学地震传感器的带宽从1 Hz扩展到了30 Hz,两种器件的采集结果具有很好的相关性和一致性,相关系数为0.887,在1 Hz处的噪声低于120 dB。

关键词 : 微机电系统, 电化学地震传感器, 平面电极, 低频震动检测

Abstract : For higher fabrication costs and poor consistency of electrochemical seismic sensors, a new structure for an electrochemical seismic sensor with planar electrodes based on Micro-electric-mechanical System (MEMS) was presented. A 2D calculation model for the seismic sensor designed was built. The key structure parameters, such as the widths of electrodes, the space between electrodes and the height of the channel which might affect the performance of the seismic sensor, were calculated and optimized by the multi-field coupling numerical simulation method with Comsol software. Through the MEMS surface processes and quasi-LIGA (Lithographie Galvanoformung Abformung) process, the MEMS based electrochemical seismic sensor with planar electrodes was fabricated and packaged. Finally, the characteristic experiments of the frequency response and the tiny-vibration testing for the sensor designed and the traditional seismic sensor based on precise-machining (MET 2003) were carried out. The experiments show that the frequency bandwidth of the sensor designed is expanded from 1 Hz to 30 Hz as compared with that of the MET 2003 and the consistency between the sensor designed and MET 2003 is achieved to 0.887. The noise level is less than 120 dB at 1 Hz.

Key words : Micro-electro-mechanical System(MEMS) electrochemical seismic sensor planar electrode low frequency vibration detection

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