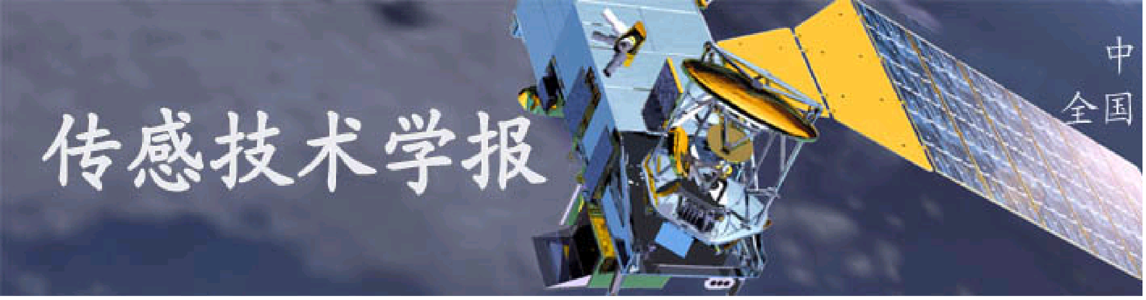

基于硅晶圆键合工艺的MEMS电容式超声传感器设计

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摘　要：

针对目前电容超声传感器多采用表面工艺制备，存在振膜应力大、厚度均匀性控制差且表面需要沉积分立电极而造成
的缺点，本文提出基于硅晶圆键合工艺的MEMS电容超声传感器。采用应力小、厚度均匀的SOI顶层硅作为敏感单元
极，易于加工且频率偏差小。通过下电极的区域化定义及巧妙互联，避免了非活跃区的寄生电容。通过Ansys及Matl
间、满足水下成像需求的传感器结构进行性能分析，表明传感器的电容变化量为650.62fF/Pa~10.827fF/Pa，满足现有条
Pa。与同频率指标的传统基于牺牲工艺而制备的金属-氮化膜堆栈结构对比表明，本结构频率可预测性高，偏差仅为0
432%以上；灵敏度平均提高11.9249dB。

关键词：超声传感器；一体化全振薄膜；ANSYS；电容；硅晶圆键合；灵敏度

Design of MEMS Capacitive Ultrasonic Transducer Based On Wafer Bonding

Author's Name:

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Abstract:

In view of the low sensitivity, small normalized displacement and frequency deviation caused by the high stress, nonuniform
separate metal film in current process, this paper presents a novel structure for MEMS capacitive ultrasonic transducers bas
technology. The structure consists of the integration vibration membrane, which make full use of the well-known material pr
SOI(low intrinsic stress, good uniformity, simple fabrication), that no extra separate metal film is required thus the fabricatio
definition of the local bottom electrode and ingenious connection, the parasitic capacitance is reduced. Five kinds of the dev
124 kHz~484 kHz that can be fabricated in the same wafer and work underwater. The capacitor variation is 650.62fF/Pa-10.82
1.700mV/Pa through the analysis of Ansys and Matlab. By the comparison with the traditional metal-nitrides membrane stac
can see that the novel transducer has a more reliable frequency with the error of 0.0535%, and a better uniformity of the defle
normalized displacement. Above all, the sensitivity increases 11.9249dB in average.

Keywords: ultrasonic transducer; integration vibration membrane; ANSYS; capacitance; wafer bonding technology; sensitiv