工业化硅微机械电容式麦克风的设计与性能计算

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摘　要：

给出了一种单芯片硅微机械电容式麦克风的结构设计，并针对此结构对其进行了动态特性分析计算。硅微机械电容式麦克风的两个电极由一个复合敏感膜和一个金属铜底板构成。复合敏感膜包括三层，中间一层是掺杂硼的多晶硅，上下两层是氮化硅，三层复合膜的厚度设计和制作工艺使复合膜处于轻微的拉应力状态。底板采用低温电镀铜技术制作，底板上分布有许多圆形通气孔来调节敏感膜与底板间的空气压膜阻尼。在复合敏感膜和金属铜底板之间采用牺牲层技术制作了一空气间隙，使复合敏感膜和一个金属铜底板之间构成一工作电容。在硅基体的背面采用湿法腐蚀出声音进口腔。针对这一结构我们对其动态特性进行了分析计算，计算出麦克风在 偏置电压下开环灵敏度为 ，麦克风最大偏置电压为 ，麦克风工作时的频率带宽为 -。分析结果表明该硅微机械电容式麦克风能满足工业界的使用要求。

关键词：硅微机械电容式麦克风；三层复合膜；带孔的铜底板；动态特性

Design of Industrial Silicon Condenser Micromachined Microphone and Its Performance Calculation

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Abstract:

A single-chip silicon condenser micromachined microphone for industrial use has been designed. The microphone has a sensing sandwich diaphragm and a perforated copper backplate. The sensing diaphragm consists of a heavily doped layer of polycrystalline silicon sandwiched between two layers of silicon nitride. The backplate is made using copper electroplating technology and perforated with circular holes. A gap between diaphragm and backplate is formed by sacrificial technology and an acoustic entrance hole on the substrate is opened using backetch technology. For this microphone, we analyzed and calculated its dynamic character. We got the open-circuit sensitivity of microphone was with bias voltage, the pull-in voltage of microphone was and the frequency bandwith of microphone ranged from to . The result of analysis shows the microphone can meet the requirement of industrial use.

Keywords: silicon condenser micromachined microphone; sandwich diaphragm; perforated copper backplate; dynamic character

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