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微纳技术与精密机械

陶瓷微热板阵列式可燃气体传感器

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摘要： 设计了基于陶瓷基底的悬桥式微热板结构以解决硅微热板高温稳定性差的问题。分析了微热板的传热过程,并通过有限元工具对其稳态热响应特性及微加热器电极结构进行了模拟。采用常规微电子技术结合激光微加工技术,实际制作了基底厚度为100 μm,桥宽度为2 mm的微结构,并对结构的加热功率-温度关系进行了测试。结果表明:热板具有较好的高温稳定性,1.5 W加热功率可使板上平均温度达到630℃。将桥式微热板作为阵列传感器的加热平台,Pd掺杂原子数百分比为0.2%和10%的SnO_2纳米材料分别作为阵列中两只传感器的敏感膜材料,设计并制作了阵列式气体传感器。传感器在恒电压加热方式下可实现CO或CH_4单一模式气体检测;阵列传感器在高、低温脉冲电压加热模式下可实现对CO和CH_4两种混合气体的定量检测。

关键词： 陶瓷微热板 气体阵列传感器 一氧化碳 甲烷 工作温度

Gas sensor array based on ceramic micro-hotplate for flammable gas detection

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Abstract: A ceramic hotplate with the structure of suspending bridge was designed to improve the thermal stability of silicon micro hotplates. The heat transfer process of the hotplate was analyzed and the characteristics of steady-state thermal response and the electrode structure of a heater were simulated by using the finite element method. Combined the conventional microelectronic technology and laser micro processing technology, the microstructures with thickness of 100 μm and bridge width of 2 mm were produced actually and the property of power assumption verses the temperature was measured. The results show that the hotplate has good stability at high temperature, and the average temperature on the ceramic hot-plate can reach 630℃ when a 1.5 W heating power is applied.By taking the ceramic hotplate as heating platform and nano-scale SnO_2 materials with Pd doping concentration of 0.2% and 10% (atom number percentage) as sensitive membrane materials, respectively, the array with two sensors was designed and fabricated.Experiments show that when the sensor array works in the constant voltage heating mode, it can be used as a single sensor with good response to CO or CH_4 gases. When the sensor array works at pulse voltage heating mode with alternating high or low working temperatures, it can realize quantitative detection for mixed gases of CO and CH_4.

Keywords: ceramic hot-plate gas sensor array carbon monoxide methane working temperature

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