Pressure sensors based on MEMS, operating in harsh environments (touch-mode)

ABSTRACT

In this paper, Poly-crystalline silicon carbide (poly-sic) Micro-electromechanical systems (MEMS) capacitive pressure sensor operating in harsh environment in touch mode is proposed, The principle of the paper is to design, obtain analytical solution and compare the results with the simulation for a circular diaphragm deflection before and after touch point. The sensor demonstrated a high temperature sensing capability up to 400℃, the device achieves a linear characteristic response and consists of a circular clamped-edges poly-sic diaphragm suspended over sealed cavity on a silicon carbide substrate. The sensor is operating in touch mode capacitive pressure sensor, The advantages of a touch mode are the robust structure that make the sensor to withstand harsh environment, near linear output, and large over-range protection, operating in wide range of pressure, higher sensitivity than the near linear operation in normal mode, The material is considered to be used for harsh environment is SiC (Silicon Carbide), Because of SiC owing excellent electrical stability, mechanical robustness, and chemical inertness properties and the application of pressure sensors in harsh environments are, such as automotive industries, aerospace, oil/logging equipments, nuclear station, and power station. We are simulating MEMS capacitive pressure sensor to optimize the design, improve the performance and reduce the time of fabricating process of the device. The proposed touch mode MEMS capacitive pressure sensor demonstrated diaphragm ranging from 150 ε m to 360 ε m in diameter, with the gap depth from 0.5 ε m to 7.5 ε m and the sensor exhibit a linear response with pressure from 0.05 Mpa to 10 Mpa.

Keyword: Micro-electromechanical systems (MEMS); Touch mode capacitive pressure sensor; High-temperature; Poly-crystalline silicon carbide; Harsh environment