Fiber Optical Pressure Sensor Fabrication using MEMS technology

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(Abstract)

A technology for fabricating fiber optic pressure sensors is described. This technology is based on intermediate-layer bonding of a fused silica ferrule to a patterned, micro-machined fused silica diaphragm, providing low temperature fabrication of optical pressure sensor heads that can operate at high temperature. Fused silica ferrules and fused silica diaphragms are chosen to reduce the temperature dependence. The fused silica diaphragms have been micro-machined using wet chemical etching in order to form extrinsic Fabry-Perot (FP) interferometric cavities. Sol-gel is used as an intermediate-layer for both fiber-ferrule bonding and ferrule-diaphragm bonding at relatively low temperature (250 °C). The pressure sensors fabricated in the manner can operate at temperatures as high as 600 °C.

The self-calibrated interferometric-intensity-based (SCIIB) technology, which combines fiber interferometry and intensity-based sensing method into a single sensor system, is used to test and monitor the pressure sensor signal. The light returned from the FP cavity is split into two channels. One channel with longer coherence length can test the effective interference generated by the FP cavity, while the other channel with shorter coherence length can get signal proportional only to the source power, fiber attenuation, and other optical losses. The ratio of the signals from the two channels can compensate for all unwanted factors, including source power variations and fiber bending losses. [11]