Insertion Probe Design of A MEMS Mass Flow Meter

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In the application of the MEMS thermal mass flow sensing technology in a closed conduit, the sensor placed on an insertion probe with the combined calorimetric and thermal dissipative sensing has been previously demonstrated to achieve the extended dynamic range. While the calorimetric sensing is often preferred for accuracy, the limited spacing available for calorimetric sensing elements on a MEMS sensing chip confines the measurable flow range. However, as the calorimetric and dissipative sensing principle require different schemes for temperature compensation, it complicates the design and manufacture process. In this paper, we present a new design that shall use only calorimetric sensing that the MEMS calorimetric sensor is packaged forming a plate in a “dual bypass” flow channel on the insertion probe. The sensing elements are positioned at tip of the insertion probe which is further placed at the centre of the closed conduit for maximum sensitivity. It is found that the structured probe can have an dynamic range over 200:1 with the calorimetric sensing elements. Detailed design, experimental data as well as application field tests are addressed in this paper.