A Valveless Micro Impedance Pump Drive by PZT Actuation

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ABSTRACT

This paper presents the fabrication and preliminary experimental studies of flow performance on a valveless micro impedance pump actuated by the shear mode PZT actuator, a novel method of pumping fluid on the microscale. The micro impedance pump was constructed of three nickel electroforming components, two glass tubes, a PZT actuator and a glass substrate. The three electroforming components include a bottom structure plate, a channel plate and a vibration plate. The AZ-type positive photoresist was used as the electroforming mould, which was patterned by UV lithography. The top and bottom structure plates were aligned and assembled with the channel plate by epoxy adhesive such that a micro channel with a compressible section coupled at both ends to rigid sections of different impedance was formed. A pressure head can be built up to drive flow through the accumulative effects of wave propagation and reflection originating from the periodic PZT excitation, located asymmetrically along the length of the compressible section of the channel. Experimental results showed that the flow was reversible and pressure heads had a highly non-linear dependence on the frequency and amplitude of the excitation. Maximum flow rates of 13 ul min-1 have been achieved with the channel size of 15 um high and 3 mm wide.

Keywords : valveless ; micro impedance pump ; PZT actuator ; electroforming

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