A Micromachined Vacuum Pump

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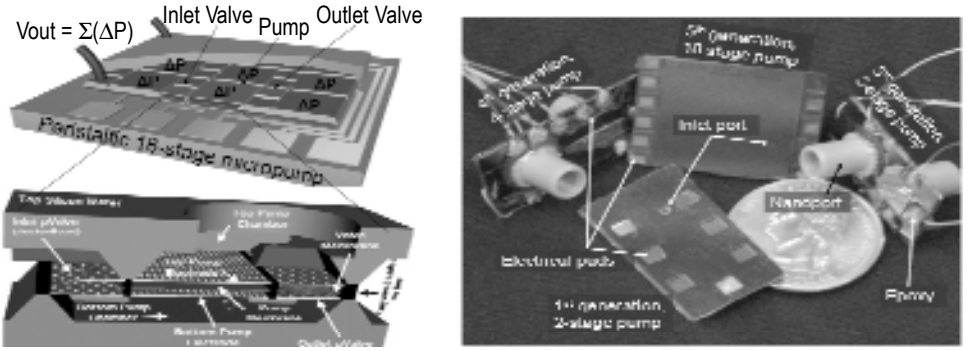
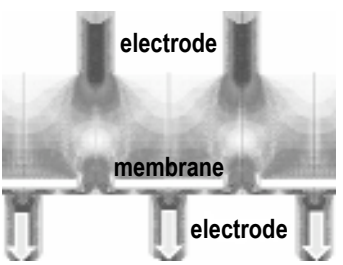


WIMS multiple-stage micropump.

Miniaturized 2-, 4-, and 18-stage peristaltic pumps have been developed and successfully implemented for efficient gas delivery in the environmental monitoring microsystem. The developed gas micropumps support chromatographic separation and detection of complex airborne mixtures by pumping airborne samples through a long separation column, with high pressure (up to 18kPa) and high flow rates (up to 4sccm) for fast-analysis, using very little power (<100mW) which is desirable for a portable system. Valve airflow between the inlet and the outlet was simulated for different dimensions to minimize flow resistance. The development of future micropumps will focus on performance improvement and compatibility with the full environmental monitoring systems. New actuation mechanisms of pump/valve membranes will be investigated to increase overall pressure-generation capability of the pump. Bi-directional gas flow control in association with microvalve timing will be addressed. A closed-loop control over the multiple stages will be pursued for accurate gas flow control by integrating flow sensors and relevant circuits for self-monitoring and feedback. This project is supported by the Engineering Research Centers Program of the National Science Foundation under award number EEC-9986866.



Valve airflow simulation.