Docket #: S03-150

Improved Pumping Media for E-O pumps

Electroosmotic (EO) pumps (also known as electrokinetic pumps) generate fluid flow and pressure in a compact system with no moving parts. They can be combined with microchannel heat exchangers to provide cooling for microelectronics. Researchers in Dr. Juan Santiago's laboratory at Stanford University have developed a patented pumping medium for EO pumps made of porous silicon. Compared to current methods, the technology provides higher flow rate per power and improves the performance and efficiency of EO pumps by allowing a lower voltage requirement at a given flow rate. This increased efficiency may provide a low-power, high flow rate, high pressure, small form factor, vibration-free pump for a variety of applications including drug delivery, portable chemical analysis, and cooling of microelectronic devices.

Related Technologies
The Stanford Microfluidics Laboratory has developed several additional technologies related to EO pumps:
--Bio Application of E-O Pump (Stanford Docket S02-303)
--An Orientation Independent EO Pump (Stanford Docket S05-116)
--Controlling Electrolytically Generated Gas Bubbles in In-Plane Electro-osmotic pumps (Stanford Docket S07-342)

Applications

- Drug delivery
- Portable chemical analysis systems
- IC chip cooling

Advantages

- High flow rate per power ratio
- Higher thermodynamic efficiency
- Higher flow rate per applied voltage
- Smaller form factor
- Manufacturing compatibility - the pumping medium is compatible with standard semiconductor manufacturing processes

Publications

- Pending U.S. Patent Application: "METHOD AND APPARATUS FOR IMPROVED PUMPING MEDIUM FOR ELECTRO-OSMOTIC PUMPS" (Publication No. 20090061601)
- Yao, S., Myers, A.M, Posner, J.D., Rose, K.A., and Santiago, J.G., "Electroosmotic Pumps Fabricated from Porous Silicon Membranes," Vol. 15, No. 3, Journal of Microelectromechanical Systems, pp. 717-728, 2006.
- Kim, D., J.D. Posner, and J.G. Santiago, "High Flow Rate per Power Electroosmotic Pumping using Low Ion Density Solvents," *Sensors and Actuators A: Physical*, 141, pp. 201-212, 2008.
- Buie, C. R., D. Kim, S. Litster and J.G. Santiago, "An Electroosmotic Fuel Pump for Direct Methanol Fuel Cells.," *Electrochemical and Solid State Letters,* 10, 11, pp. B196-B200, 2007.
- Yao, S., Myers, A.M, Posner, J.D., Rose, K.A., and Santiago, J.G., "Electroosmotic Pumps Fabricated from Porous Silicon Membranes," 15, 3, *Journal of Microelectromechanical Systems*, pp. 717-728, 2006.
- Laser, D. and J.G. Santiago, "A Review of Micropumps," *Journal of Micromechanics and Microengineering*, 14, 6, 2004

Patents

- Published Application: 20090061601
- Issued: 7,458,783 (USA)

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