Electronic Cooling Systems Based on Fixed-Valve Micropump Networks

D.Faulkner, R.Shekarriz
MicroEnergy Technologies, Inc.
Vancouver, WA

C.J.Morris, J.Y.Chung, P.E.Rahm, F.K.Forster
University of Washington
Seattle, WA

Thermal control of electronics in portable computers and space vehicles where compactness, weight, efficiency, simplicity, reliability, and cost are important is an area ideally targeted for MEMS-based approaches. Micropumps based on diaphragm actuation and using fixed-geometry valves have the potential to meet all these criteria when used for fluid transport in closed-loop, forced-convection, thermal-management systems. To investigate this potential application, an integrated cooling module was designed, fabricated, and tested. It consisted of a network of four planar micropumps fabricated in plastic and a copper microchannel heat sink. Plastic allowed rapid prototyping and resulted in a multilayer pump network 32 by 32 by 11 mm thick. Other materials could reduced the total thickness significantly. To our knowledge this work is the first application of a scalable network of micropumps. Thermal power handling of 35 watts was possible with average pump power of 70 mW at a flow rate of 11 mL/min using water as the coolant.