

Autonomous Valves in Micro-fluidic Manifolds based on Versatile Photoresponsive Ionogels

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Versatility in valve actuation within micro-fluidic devices is very desirable since precise flow control, provision of exact reagent amounts, contamination prevention between reagents, autonomy, disposability and low-cost manufacture are factors that cannot be found today for microfluidic valves. Valves made using photo-responsive gels are of great interest as functional materials within micro-fluidic systems since actuation can be controlled by light irradiation, without physical contact, unlike equivalent electro-actuated valves. Nevertheless, their poor versatility, slow response times and limited robustness render them currently as scientific curiosities rather than ideally functioning devices.[1]

The incorporation of photoresponsive gels with ionic liquids (ILs), ionogels, produces hybrid materials with many advantages over conventional materials. For example, through the tailoring of chemical and physical properties of ILs, robustness, acid/ base character, viscosity and other critical operational characteristics can be finely adjusted. Therefore, we can tune the characteristics of the ionogels by changing the IL and so more closely control the actuation behaviour of micro-valves made from these novel materials. In this paper, we present the preparation and performance of four different ionogels as micro-valves in microfluidic systems. It was found that simply varying the ILs, actuation can be modulated on demand.

[1] Sugiura, S.; Sumaru, K.; Ohi, K.; Hiroki, K.; Takagi, T.; Kanamori T., *Sens. Actuators A* 2007, 140, 176-184.