

Smart Materials for Liquid and Micro-vehicle Movement Control in Microfluidics:

The Key to Realising Next Generation Chemical Sensors:

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Autonomous chemical sensing platforms capable of operating independently for long periods of time (months, years) at an acceptable cost are not currently available, and it can be argued that the state of the art has not advanced significantly despite decades of intensive research. The key issue is how to maintain such devices within calibration, and to validate their calibration status remotely.

New approaches to controlling sample and reagent movement in microchannels is could play a central role in the realisation of autonomous chemical sensing platforms with capabilities that go well beyond those of existing sensor technologies. In this lecture, I will discuss how photo-responsive molecules can be used to control liquid movement in microfluidic channels. In particular, I will show how tuning the composition and the porosity of NIPAAm-type gels incorporating spiropyran derivatives can produce dramatic improvements in critical characteristics of gel actuators such as re-swelling dynamics, extent of actuation and effective pH range. I will also discuss mechanisms by which photo-induced movement of micro-vehicles like droplets can be achieved in fluidic channels.