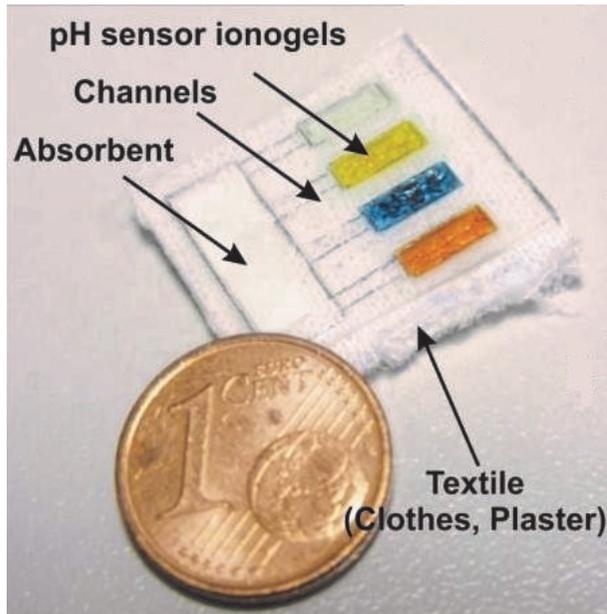


Sensors & actuators using microfluidics and ionogels



We have developed an innovative and miniaturisable sensing platform able to continuously measure for example, the pH of solutions and vapour streams during chemical or biological processes. The autonomous sensing platform is based on micro-fluidics and novel ionic liquid polymer gels (ionogels) and

performs long-term real-time continuous monitoring.

The ionogel matrix is very robust even in harsh pH conditions (0-14). The ionogel-dye interactions ensure no leaching of the dyes thus providing extended durability of the sensor and the accuracy of the pH readings.

The colour pattern of the barcode corresponds with the sensed pH value and is accurate to 0.5 pH units for visual inspection. Using optical detection the accuracy increases to 0.1 pH units.

We have also developed novel smart ionogels that are photo responsive. This advance allows us to fabricate pumps and valves that enhance the capabilities of micro-fluidic systems. We can now control flows, on/off switching and the sealing of liquids. The non-contact actuation of the valves is by light irradiation.

Benefits

- Continuous real-time analysis
- Wearable
- Robust
- Flexible
- Disposable
- Autonomous
- Non-invasive
- Cost effective
- Visual readout
- Reconfigurable
- No electronic noise

Applications

- Health
- Bio-sensing
- Chemical sensing
- Industrial chemistry
- Point-of-care diagnosis
- Environmental sensing

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Potential applications

The market for wearable sensors is growing exponentially. Currently it is being driven by the health/sports sector but we see huge potential in remote health monitoring of patients as the economics of healthcare move from a hospital-centred approach.

There is a very wide field of application for microfluidic/ionogel sensors. In addition to the application areas listed overleaf we are investigating smart wound dressings. Here our sensors can visually record the healing state of chronic wound conditions based on the pH value of the wound bed.

We have also demonstrated in field trials small wearable sensors for monitoring the pH of perspiration during exercise.

Benefits

Ionic liquids, and in particular ionogels, have excellent chemical and thermal stabilities, low vapour pressure, high ionic conductivity and tuneable hydrophobic and hydrophilic nature.

Ionic liquids have been labelled “designer solvents” because it is possible to tailor their anions and/or cations for specific functions such as catalysis, solubility and viscosity, and sensing. Incorporating ionic liquids into polymer gels, to produce so-called ionogels, is very attractive as it generates materials with the inherent advantages of ionic liquids within a solid or semi-solid gel-type structure.

The technology we have developed is able to provide the next generation of sensors with very good sensitivity, selectivity and stability for extended periods of real-time operation.

We have technology for:

- Continuous pH sensing
- Microfluidic pumps and valves
- Gas sensing
- Chemical and biochemical sensing
- Surface modification
- Hydrophobicity & hydrophilicity
- Printing technology

The research group is keen to engage with companies interested in further developing the technology

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