Configurable 3D-Printed
Millifluidic and Microfluidic ‘Lab on a Chip’
Reactionware Devices

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**Introduction**

The realisation of rapidly configurable and scalable reactor devices for the exploration of complex chemical systems is a highly sought-after target. [1] Three-dimensional (3D) printing technique can be used to make milli- and micro-scale ‘reactionware’ devices, which can be designed to realize bespoke and low-cost lab-on-a-chip devices and easily connected to in-line analytical instruments. [2] The utility of this reactionware is demonstrated by organic, inorganic and materials synthesis.

A 3DTouch™ printer can be employed to produce reactionware devices with controlled dimensions, area and shape. The use of polypropylene easily and quickly allow to fabricate cheap and robust reactors.

**Organic synthesis**

Flow synthesis of an imine derived from benzaldehyde and benzylamine. The reaction was followed in-line with an ATR-IR and the effect of the flow rate on the yield of the reaction was determined.

**Inorganic synthesis**

POM synthesis monitored by in-line UV-Vis spectroscopy and then confirmed by DLS. In the 1-inlet device only HCl is flowed through silos filled with Na₃MoO₄·H₂O and reducing agent.

**Materials synthesis**

The synthesis of gold nanoparticles is followed by UV-Vis spectroscopy then confirmed by DLS. The device inlets are connected to pumps that flow aqueous solutions of: (A) HAuCl₄/citrate and (B) NaBH₄.

**Conclusion**

It is demonstrated the versatility and configurability of completely reusable and bespoke millifluidic and microfluidic reactionware. Within the timespan of one day a geometry tailored to a specific reaction can be designed and printed with a extremely low-cost fabrication technique. As an added benefit it is very simple to alter the design of the devices in terms of geometry, inlets, outlets and sizes of channels that is very rare with traditional fluidic devices, where redesign and refabrication of devices can be time consuming. Further work aim to increase the versatility of the miniaturised devices, especially for applications in complex chemical systems and integrated bio-and-chemo-reactionware.

**References**