Here we present the functionalisation of the inner walls of micro-capillaries with polymeric coatings based on a spiropyran (SP) derivative and their successful use as capillary integrated optical sensors for a variety of target analytical species (divalent metal ions, solvents of different polarities, H\(^+\)). The polymeric brushes approach offers a nanostructured to microstructured responsive coating ensuring small diffusion paths and fast response times towards the target species. Moreover, this sensing behavior can be switched ON-OFF using light of appropriate wavelengths.

**Micro-capillary Functionalisation Process**

The inner walls of fused silica micro-capillaries were successfully coated with spiropyran polymeric brushes using surface-initiated ring-opening metathesis polymerisation [1]. Scanning Electron Microscopy imaging of the SP brushes inside the micro-capillary showed that coatings having lengths of about 2-3 µm were obtained.

**Photochromic Performance**

Based on the inherited spiropyran properties, the functionalised capillaries were successfully used to photoidentify solvents of different polarity (toluene, tetrahydrofuran, acetone, acetonitrile, ethanol, and methanol) when passing through the micro-capillary in continuous flow [2].

**Sensing Properties. 1. Solvent Sensing**

SP-polymer brushes modified micro-capillaries are capable of detecting different metal solutions that are passing through the modified micro-capillary in continuous flow, based on changes in colour (absorbance spectra) of the coating after irradiation with UV light. Five different metal ions solutions of Co\(^{2+}\), Ni\(^{2+}\), Cu\(^{2+}\), Cd\(^{2+}\) and Zn\(^{2+}\) were detected.

**Applications**

- On-demand solvent sensing
- On-demand metal ions sensing/binding and releasing in continuous flow
- pH sensing
- Self-diagnosing tool
- Photo-control of electroosmotic flow
- Integration into commercially available analytical equipment like HPLC and CE

**Conclusions**

A new, simple and innovative micro-capillary platform capable of solvent and metal ion detection, accumulation and release has been presented. The SP-polymer brushes functionalised micro-capillary constitutes a multi-purpose optical sensor, capable of continuous flow operation.

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