Electronic Supplementary Material (ESI) for Lab on a Chip

Electronic Supplementary Information

An Investigation into Dispersion upon Switching between Solvents within a Microfluidic System using a Chemically Resistant Integrated Optical Refractive Index Sensor

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Supplementary Figures

A – Reflected spectrum of the Bragg grating sensor device:

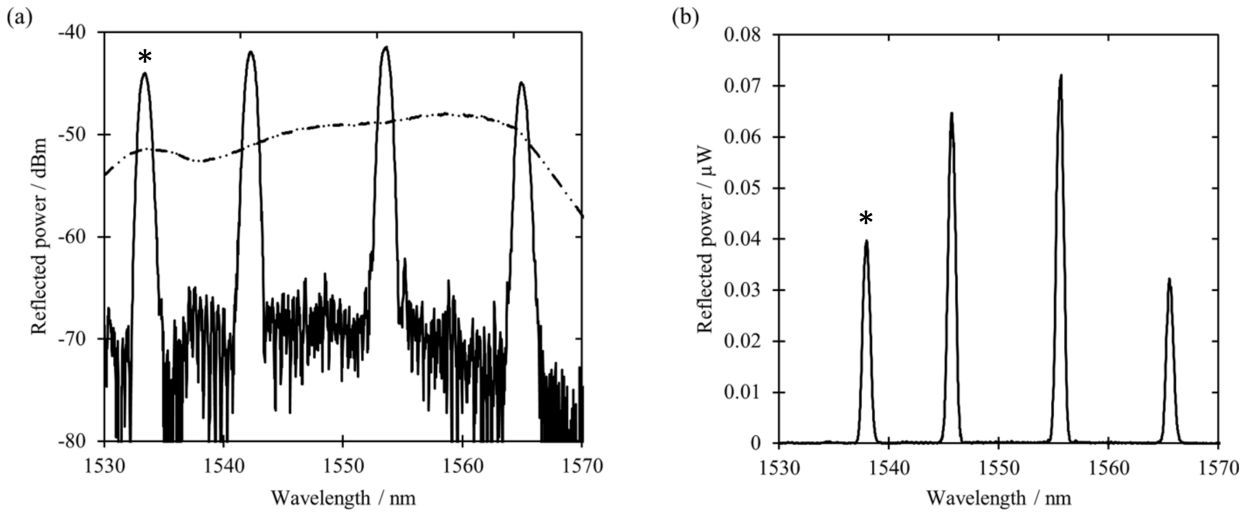

Fig. S1 The device consisted of four spectrally distinct Bragg gratings, one un-etched reference (*, ~1535nm) and three sensor gratings distributed along a linear waveguide. The reflected spectrum of the integrated optical device is plotted both **(a)** logarithmically and **(b)** linearly, showing the Gaussian profile of the Bragg peaks and low optical noise. The dashed line in **(a)** represents the 4 % reflection from the optical fibre interrogation system alone and it is this profile that leads to the variation in peak height in **(b)**.

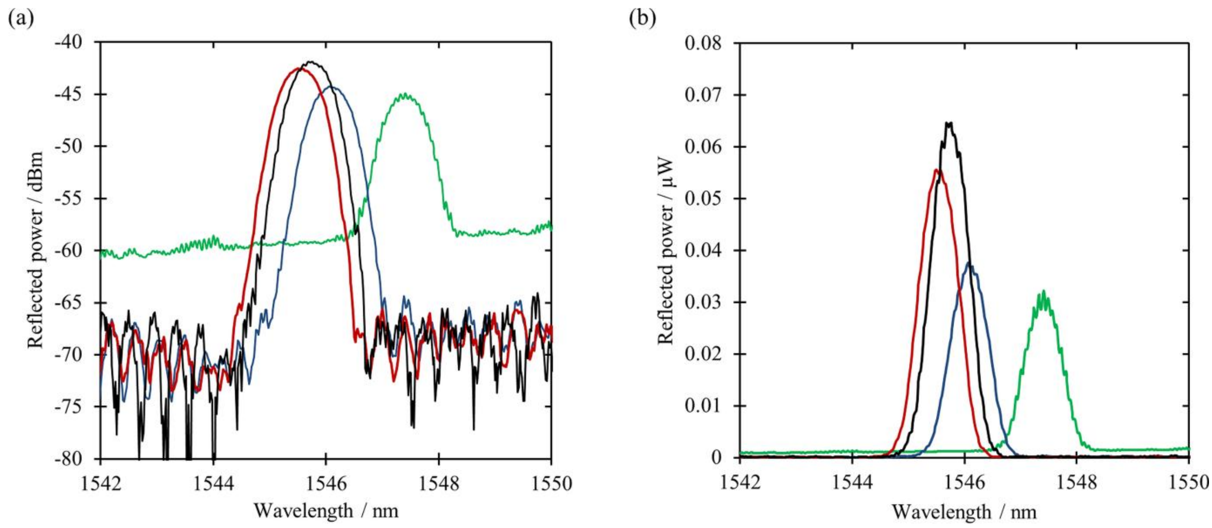

Fig. S2 The reflected Bragg peak for an un-etched (—), etched (—), polished (—) and sputtered (—) Bragg grating, plotted both logarithmically **(a)** and linearly **(b)**. On etching there is a blue-shift as the silica overclad is replaced with air of lower refractive index. On polishing the surface, a further shift is observed as silica close to the highly sensitive core is removed, combined with an increase in amplitude as scattering losses at the surface are reduced. Upon sputtering a thin-film of the high index material, tantalum pentoxide, a small red-shift is observed. The initial high background level for the un-etched device is due to a strong reflection from the end-face of the integrated optical chip; this is not seen after the etching process, where the modal mismatch between the un-etched and etched regions increases the optical loss of the device.

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B – Switching between Solvents within a Microfluidic System:

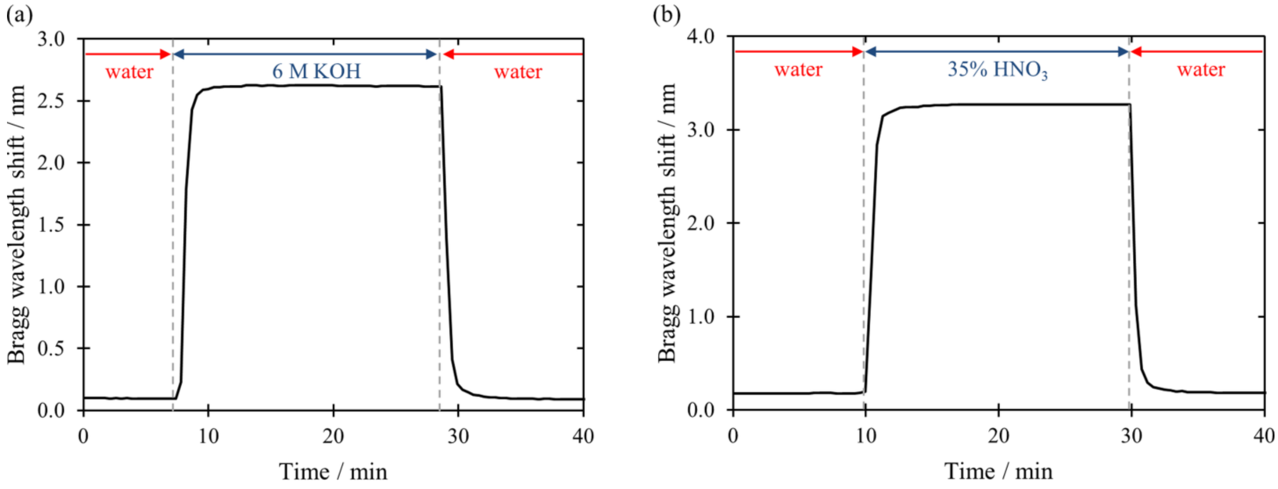

Fig. S3 The Bragg wavelength response to cycling between water and either **(a)** 6.0 M potassium hydroxide or **(b)** 35% nitric acid, within the microfluidic system demonstrating compatibility with strong acids and bases. In both instances the transition from receding to proceeding solvent took several minutes.

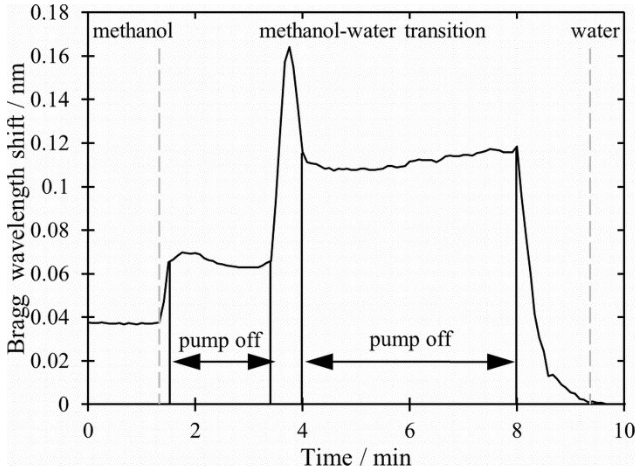

Fig. S4 The transition from methanol to water can be paused by switching off the pump and subsequently resumed to complete the spike.

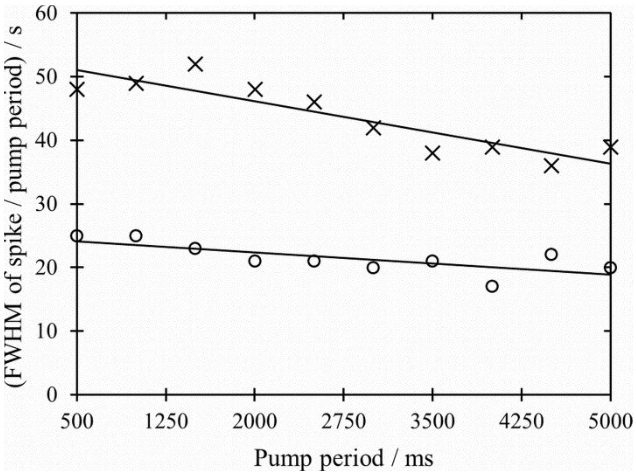

Fig. S5 Comparison of a range of transitions as a function of pump cycle indicates that the period of pumping has little effect on the spike duration, for both the water-methanol (x) and methanol-water (o) transitions.

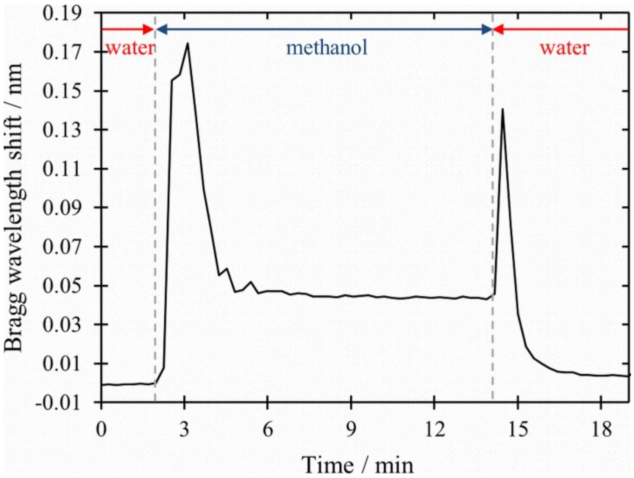

Fig. S6 The change in Bragg wavelength upon cycling between methanol and water using a peristaltic pump.

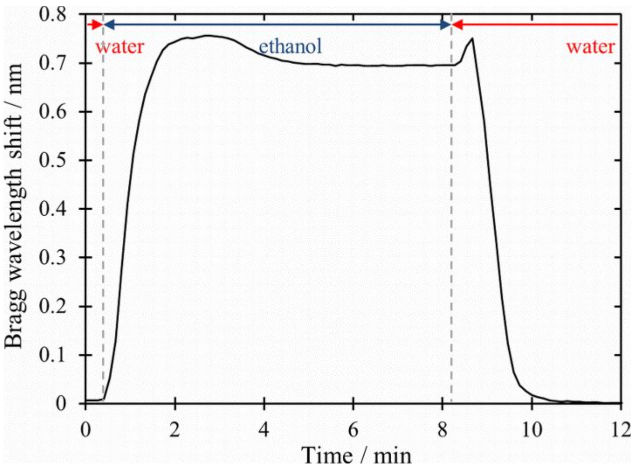

Fig. S7 The change in Bragg wavelength upon cycling between water and ethanol, illustrating the spikes produced at the solvent interface.