Electronic Supplementary Material (ESI) for Chemical Communications

Microfluidic Polymer Dual Ring Resonators for Biosensing

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Supplementary Materials

A- Materials and Methods:

1. Fabrication

The gapless SU8 polymer microdisks were fabricated on 3.5µm oxide of wafer by using electron beam lithography (EBL) in James Watt Nanofabrication Centre (JWNC, University of Glasgow), as described in Fig S2 below. The first step consists of cleaning the substrates ultrasonically by using acetone and Isopropyl alcohol (IPA) for 5 minutes each. Then, the substrates were rinsed by reverse osmosis (RO) water. The substrates were put in the oven at 180^{o}C for 5 minutes to dry. Next, the substrates were treated in the oxygen plasma at 100W, for 5 minutes. The SU8 resist was spun at 3000 rpm for 30 sec, and then soft baked for 2 minutes at 95^{o}C to evaporate the coating solvent and firm down the resist on the top of the SiO_2 after coating. The substrates were cooled down at room temperature before patterned. After electron beam patterning, substrates were post-exposure baked (PEB) for 1 minute at 65^{o}C and 1 minute at 95^{o}C and usually SU8 pattern should be visible on the resist surface after PEB process. The SU8 patterns were developed with EC solvent (Ethyl 2-hydroxypropanoate) for 2 minutes, followed by 1 minute of Isopropyl Alcohol (IPA) and dried with nitrogen gun. As a final step, hard bake was performed at 180^{o}C on the hotplate for 5 minutes. The patterned substrates were cleaved and aligned for further experiments.

The microfluidic channel was fabricated using standard soft lithography. SU8 photoresist was patterned as described, as the master on a Silicon wafer, functionalised with a hydrophobic perfluorosilane. PDMS (1/10 ratio of monomer) was poured, degassed and cured (70^{o}C for 2h), before being peeled off of the Si master. The channel was then plasma-bonded (O_2) to the SU8 DDR chip. The device was then aligned with the measurement system (Fig. S3 below).

2. Surface functionalisation.

The samples were treated with O_2 plasma for 30 s at 100 W, and incubated in H_2SO_4 (0.1 M) overnight to form hydroxyl groups. They were then functionalised with APTES (3-aminopropyltriethoxysilane, 1% v/v in ethanol 98%/water 2% v/v) for 2h, rinsed with ethanol and blow-dried. NHS-biotin (dissolved in DMSO, 25 mg/ml, diluted in PBS, final concentration of 1 mg/ml) was deposited on the samples and incubated for 1h, before being rinsed with PBS. The surface chemistry was characterised by XPS (Scienta ECSA 300 High Resolution XPS, National Centre f Electron Spectroscopy and Surface Analysis, Daresbury Laboratory, UK). The remaining processing steps (addition of different proteins) were carried out as described in the main text.

B- Supplementary Figures

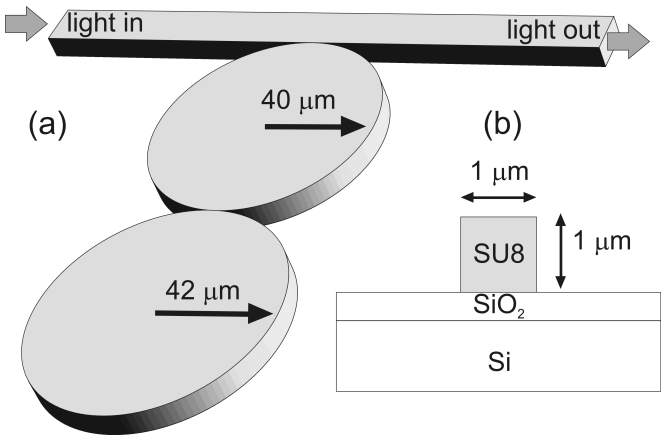

Fig. S1. Shows the (a) gapless disk resonator and (b) cross section of fabricated device.

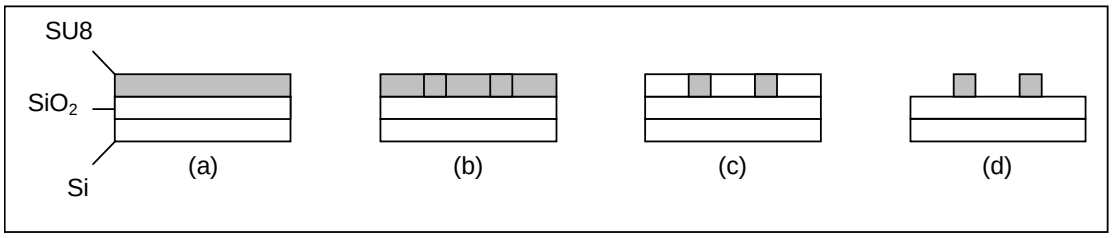

Fig. S2. Schematic illustration of SU8 fabrication process: (a) Spin SU8 resist, (b) Patterning, (c) Post exposure bake (PEB) and (d) Develop and Hard bake.

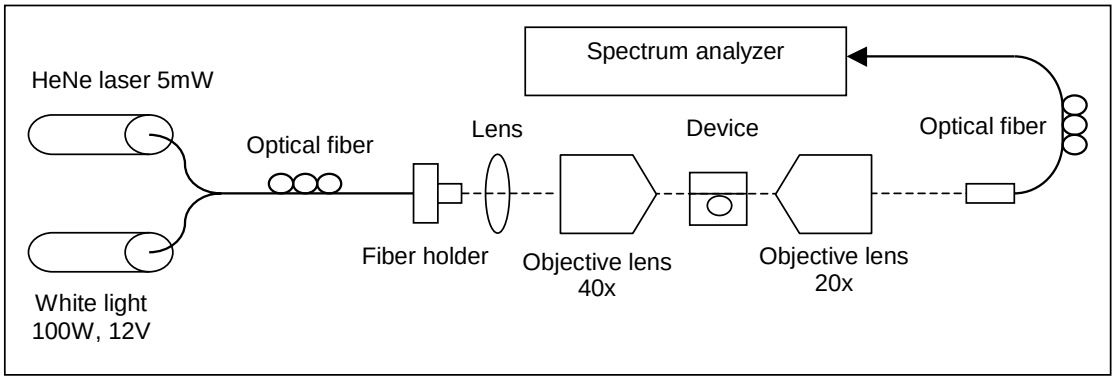

Fig. S3. Experimental Set-up.