Electronic Supplementary Material (ESI) for Chemical Communications

An Optical Deoxyribonucleic Acid-based Half-subtractor

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Experimental procedures

All oligonucleotides (dual-gate, Input I_A and I_B) were purchased from Yao-Hong Biotechnology Inc. (HPLC grade, New Taipei City, Taiwan). Sodium chloride (A. R. grade), potassium chloride, potassium dihydrogen phosphate (KH_2PO_4, >99.9%), and sodium phosphate dibasic (Na_2HPO_4, >99%) were purchased from J.T. Baker (Phillipsburg, NJ). Deionized water used in the preparation of phosphate buffered saline (PBS, 110 mM NaCl, 2 mM KCl, 8 mM Na_2HPO_4, 2 mM KH_2PO_4, pH=7.4) and for rinse solutions was 18.2 MΩ, produced by PURELAB Ultra (ELGA, Albania). All chemicals were used as received unless otherwise mentioned.

Two microliters of 50 μM dual-gate molecules were dissolved in PBS and pipetted on a screen-printed gold substrate (4 mm diameter, DropSens, Spain) for immobilization for 30 min. The dual gate–coated Au surface was then rinsed with 500 μL PBS to remove unbound molecules. Hybridization of the hairpin probes on Au was performed at room temperature for 30 min[ref*] after the same number (i.e. 2 μL 50 μM) of I_A and I_B molecules were applied under the same buffer conditions. All processes including dual-gate immobilization and hybridization were covered with aluminum foil in order to prevent photobleaching.

The fluorescence intensities were monitored with a fluorescence spectrophotometer (F7000, Hitachi High-Technologies, Japan) equipped with a solid sample holder. The emission wavelengths were 520 nm and 694 nm for fluorescein and Cy5, respectively. The relative intensities of samples were calculated by $(I_{hybrid} - I_{blank})/ I_{blank}$, where I_{hybrid} and I_{blank} were the fluorescence intensities of dual-gate on gold after and before hybridization with the target sequences.

ref*: see ref 6 in the text.