Electronic Supplementary Material (ESI) for Lab on a Chip

An Electrochemical Lab-on-a-CD System for Parallel Whole Blood Analysis

Tingjie Li, Yaxi Fan, Yang Cheng and Jun Yang*

Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada

E-mail: jyang@eng.uwo.ca

The detailed procedure for the fabrication of biosensor.

(1) Define the surface area of the electrode system on a silicon wafer (with a 1000 nm thick silicon dioxide layer on top) using positive photoresist and deposite a 100 nm thick Au layer over the patterned photoresist layer. Lift off the photoresist, leaving an area with coated Au to be used for the electrodes, the leads and the conductive pads.

(2) Define the surface area of the working electrode using positive photoresist and deposited a 500 nm thick Zn layer on top of the Au layer. Lift off the unwanted Zn area and formed the nanoporous structure on the working electrode.

(3) Define the surface area of the reference electrode using positive photoresist and deposited a 500 nm thick Ag layer on top of the Au layer. Lift off the unwanted Ag area and dipped the wafer sample into 50 mM $FeCl_3$, forming a Ag/AgCl standard reference electrode.

(4) Cover the leads with a layer of negative photoresist, only exposing the areas of the electrodes and the conductive pads on the whole wafer.

(5) Physically deposit 10 µL of MWCNTs (1 mg/ml) onto the surface of the working electrode. MWCNTs can further enlarge surface area of electrode, and even more importantly, PB deposited on the MWCNT modified electrode was found to be stable in solutions.

(6) Electrochemically deposit a PB layer as a catalyst layer, physically deposit bovine serum albumin (BSA) and enzyme mixture as a biomarker layer, and physically deposit 10% Nafion solution as a semi-permeable layer. These layers are all overlaid on the working electrode (Fig. S1).

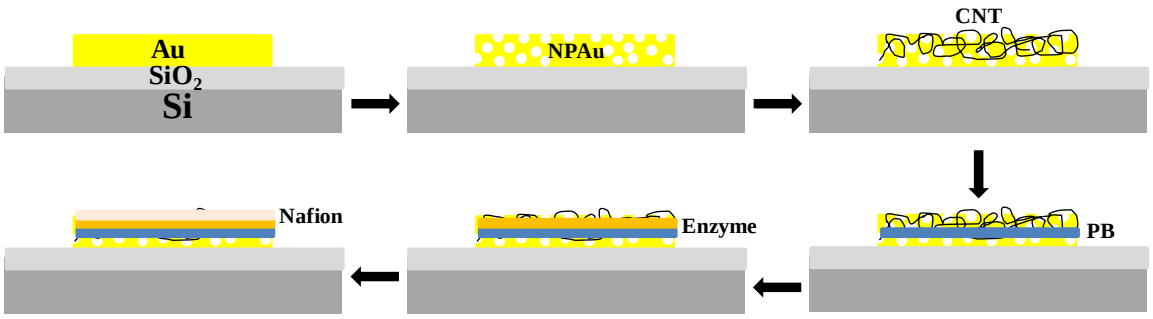

Fig. S1 Schematics of the fabrication process for working electrodes

The detailed procedure for the blood analyses using the system.

(1) A 16 µL blood sample is transferred from the vacutainer tube to the inlet of the cartridge using a syringe.

(2) The Lab-on-a-CD panel is rotated at 2000 rpm for 280 sec.

(3) The Lab-on-a-CD panel stops rotating and the leads of the potentiostat are connected to the conductive pads on each section of the CD panel.

(4) Electrochemical measurements are carried out by applying potential from the potentiostat.

(5) Current values vs. time were recorded in a computer through commercial software.

(6) The current values at 150 sec are picked up and used to calculate the concentrations of analytes.

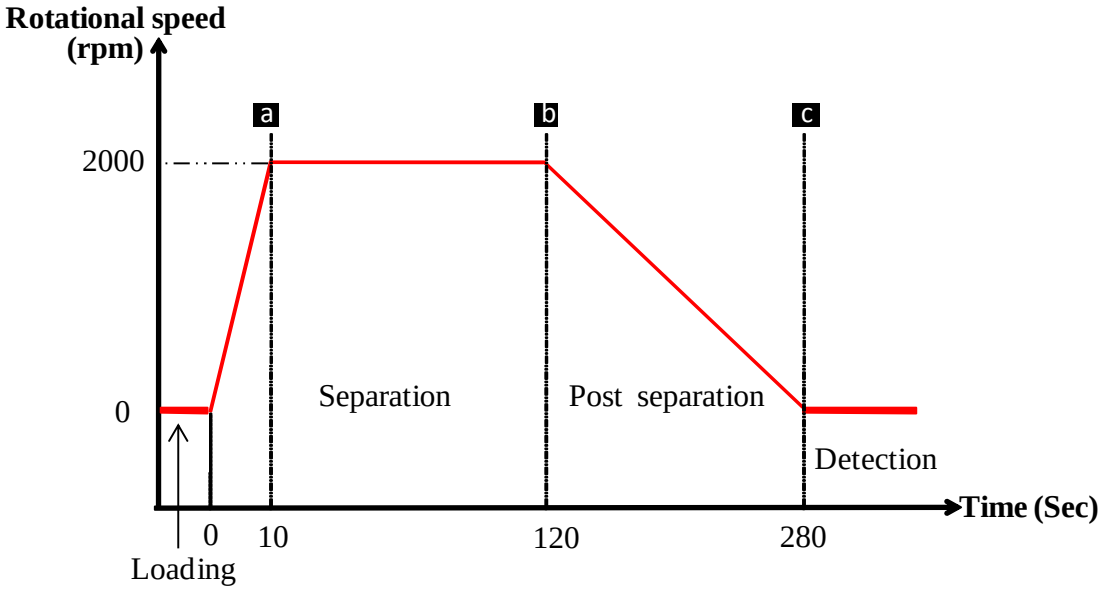

Fig. S2 Schematics of the rotational speed of each experimental step vs. time. A blood sample was loaded into the system at 0 rpm. The rotational speed was ramped from 0 rpm up to 2000 rpm in the first 10 sec. The speed was kept at 2000 rpm for 110 sec, and then slowly decreased to 0 rpm. Electrochemical measurements were conducted when the circular platform was stationary.