

Electronic Supplementary Information (ESI)

Electrochemical immunosensing system on patterned electrodes for immunoglobulin E detection

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Materials

11-Mercapto-1-undecanol (447528), 12-mercaptododecanoic acid (675067), 11-(mercaptoundecyl)ferrocene (738905), p-aminophenyl phosphate (75113), p-aminophenol (A71328), (3-aminopropyl)trimethoxysilane (281778), p-phenylene diisothiocyanate (258555), N-(3-dimethylaminopropyl)-N'-ethylcarbodiimide (39391), N-hydroxysulfosuccinimide (56485), tris-buffered saline (T5030), Tween 20 (P1379), bovine serum albumin (A2153), trizma hydrochloride (T3253), trizma base (93362), magnesium chloride (M8266) and trichloro(1H,1H,2H,2H-perfluorooctyl)silane (448931) were purchased from Sigma-Aldrich (ST. Louis, MO, USA). Goat anti-human immunoglobulin E antibody (A18797) was obtained from Thermo-Fisher Scientific (Waltham, MA, USA). Target human immunoglobulin E (11/234) was supplied by NIBSC (Hertfordshire, UK). Alkaline phosphatase-conjugated IgE antibody (9250-04) was purchased from SouthernBiotech (Birmingham, AL, USA). Horseradish peroxidase-conjugated IgE antibody, a Tetramethylbenzidine solution and a H₂SO₄ solution were provided by Komabiotech (Seoul, South Korea). A 6-mm biopsy punch was purchased from KAI MEDICAL (BP-60F, Seki, Gifu, Japan). A glass slide with a thickness of 1.1 mm was supplied by Sewon Tech (Gumi, South Korea). Sylgard 184 Silicone Elastomer was obtained from Dow Corning (Midland, MI, USA). Dimethylformamide, pyridine and ethanol were purchased from Daejung Chemicals & Metals (Siheung, South Korea).

Preparation of PDMS plates

A polydimethylsiloxane (PDMS) pre-polymer was prepared by vigorously mixing a base and a curing agent included in Sylgard 184 Silicone Elastomer at a ratio of 10:1. To facilitate the detachment of PDMS plates from a silicon wafer, the wafer surface was treated to have a Teflon film. A surface of 6" silicon wafer was treated with a UV-Ozone cleaner () for 10 min, and trichloro(1H,1H,2H,2H-perfluorooctyl)silane was deposited to the oxidized surface in a vapour phase at 80 °C for 10 min. The homogeneously mixed PDMS pre-polymer was degassed in a vacuum desiccator for at least 10 min, and poured onto the Teflon-coated silicon. After thorough removal of bubbles, the pre-polymer was cured at 80 °C for more than 2 hr. The PDMS plates were cut and detached from the wafer, and used as a PDMS layer in the sensing devices. By adjusting the amount of the reagents, we manufactured the PDMS plates with a thickness of 5 mm.

Electrochemical measurements

Electrochemical measurement processes were simplified by using a surface mount test clip (923655, 3M, Maplewood, MN, USA) in every test. We designed the electrodes of electrochemical sensors to be compatible with the test clip to achieve a one-step contact to a potentiostat for CV measurement. The electrochemical device with eight sensing units could be sequentially tested with the simple setup in a shortened analysis time.