Supporting Information Cover Sheet

Analytical Methods

Manuscript title: SWCNTs based Aptasensor System for Antibiotic Oxytetracycline Detection in Water Samples
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The Flexible Biosensor System Fabrication:

In the previous work[31], it was observed that without proper template functionalization, electrophoretic assembly could yield undesirable nanomaterials assembly onto the insulating (SiO_2) surface. To ensure that nanomaterial assembly occurs only on the conductive patterns of the template, the SiO_2 surface energy has to be reduced. Self-assembled monolayers (SAM) have been shown to significantly reduce the surface energy of a given surface. We have used Octadecyltrichlorosilane (OTS) to selectively modify the surface energy of SiO_2 layer without affecting the surface energy of the conductive gold patterns. The application of SAM of OTS increased the contact angle of SiO_2 from 10° to 100°. A post treatment process is used to selectively remove the noncovalently attached OTS SAM to the gold surface without disturbing the OTS SAM on SiO_2 surface (step 1 in the figure S1). The damascene template and a plain gold template were used as electrode and counter electrode, respectively and were immersed into SWNTs suspension (0.001 wt %, 90 semiconducting SWNTs). DC power supplier was used to apply the potential (2~2.5V) between the two electrodes. Negatively charged SWNTs were attracted onto positive conductive patterns in damascene template. The template was withdrawn with constant pulling speed (5mm/min~10mm/min) using a dip coater keeping the voltage on. Highly dense and uniform SWNTs assembly was achieved on the conductive patterns in damascene template (step 2 in the figure S1). Assembled SWNTs, then, were transfer onto PEN (polyethylene-naphthalate) (Teonex Q65A, Teijin DuPont) film using transfer printing techniques to improve the surface energy of PEN film to increase the transfer yield, PEN film was pretreated by oxygen plasma using inductively coupled plasma (ICP). A nanoimprint toll was utilized for the printing transfer process. Considering the glass transition temperature (115 °C) of PEN, 160 °C process temperature and 170 psi pressure were applied on the template and PEN film for 1 min. After cooling down to the room temperature, the film was gently peeled off from the template (step 3 in the figure S1). Above glass transition temperature, the PEN film engulfed the assembled SWNTs tightly and high yield transfer was achieved. Metal electrodes of Cr/Au (5 nm/100 nm) were defined using photolithography, electron beam deposition and lift off process.

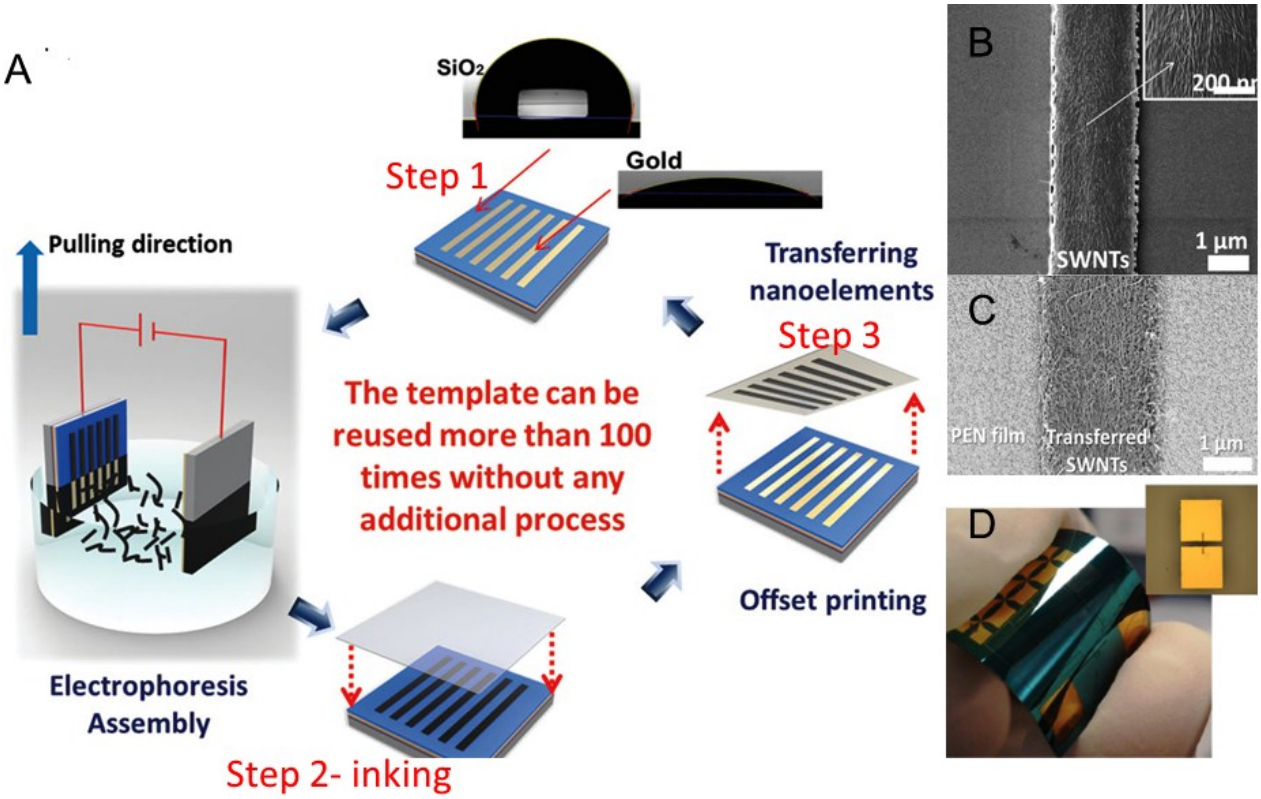

Fig. S1. Offset printing: A) A schematic of the nanoscale offset printing approach. The insulating (SiO_2) surface of the Damascene template is selectively coated with a hydrophobic SAM (Self-assembled monolayers-Octadecyltrichlorosilane (OTS)). Using electrophoresis, nanomaterials are assembled on the conductive patterns of the Damascene template ("inking"), which are then transferred to a recipient substrate ("printing"). After the transfer, the template is ready for the next assembly and transfer cycle. B) SEM image of the assembled SWNTs on the template before the transfer. C) Transferred SWNTs on recipient substrate (PEN). D) Flexible devices with array of transferred SWNTs and metal electrodes (printed on PEN). Inset is the microscopy image of two electropads and transferred SWNTs on PEN film.

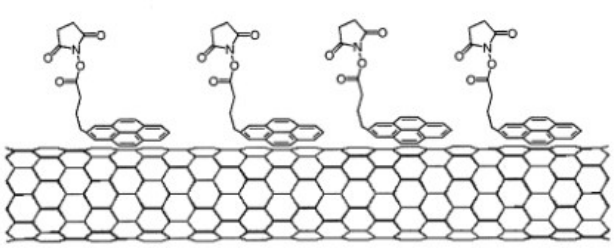

Fig. S2. 1-Pyrenebutanoic Acid, Succinimidyl Ester Irreversibly Adsorbing onto the Sidewall of a SWNT via π-Stacking[32].

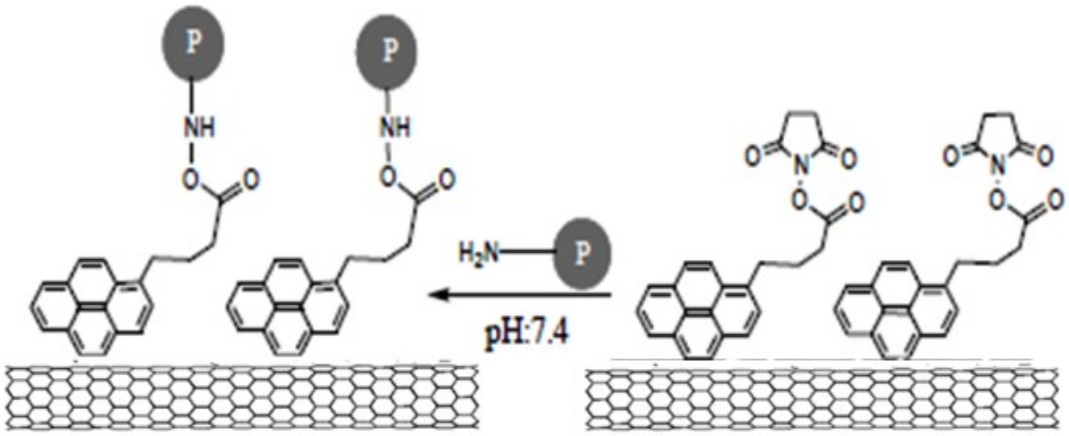

Fig. S3. Immobilization procedure of probe-molecules (amino linked probe-DNA described as NH_2-P) onto SWCNTs bridge surface by π-π-Stacking of the surface modification agent (1-Pyrenebutanoic Acid, Succinimidyl Ester) and covalent binding of the amino linked probe-DNA with NHS/EDC linker

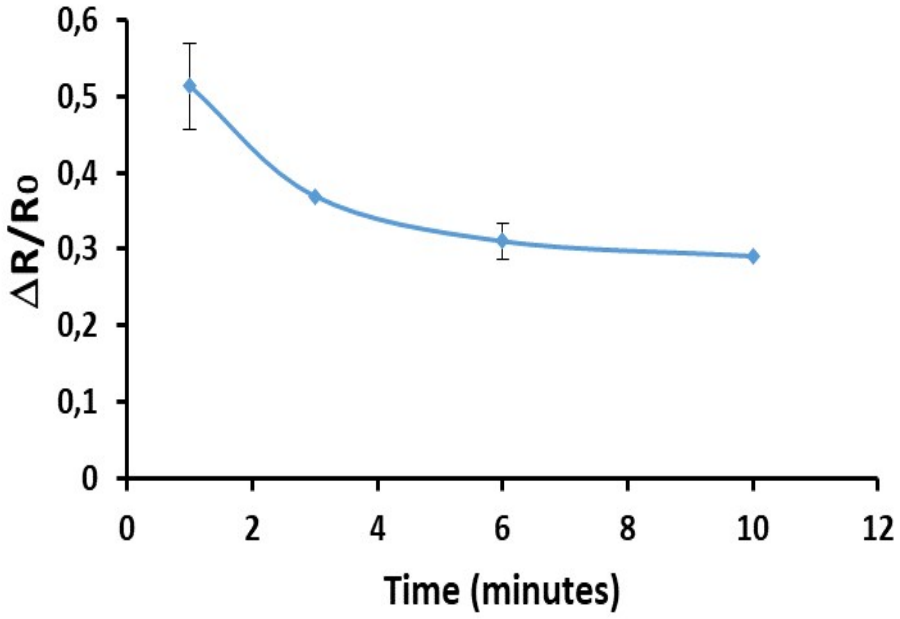

Fig. S4. Experimental optimization of the pre-mixing time length for pre-mixing of OTC (75 µg/L) and its specific aptamer (100 µg/L).