## Supplementary materials:

# A Bio-abiotic Interface Constructed by Nanoscale DNA-Dendrimer and Conducting Polymer for Ultra-sensitive Bio-molecular Diagnosis

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*DDPpy profile*:

Film thickness was measured by comparing the thickness of working electrode with that of the counter electrode, since the polymer film is localized on the working electrode. The thickness measurement was done by profilemeter (Dektak 6 Surface Profile Measuring System, Veeco). For each specific polymerization condition, triplet measurements are carried out. By fitting the thickness distribution with Gaussian profile, DDPpy thickness under electric pulse for 500s is determined to be 51.5 ± 3.0 nm, while thickness of Ppy only film under electric pulse for 500 s is 17.2 ± 1.8 nm.

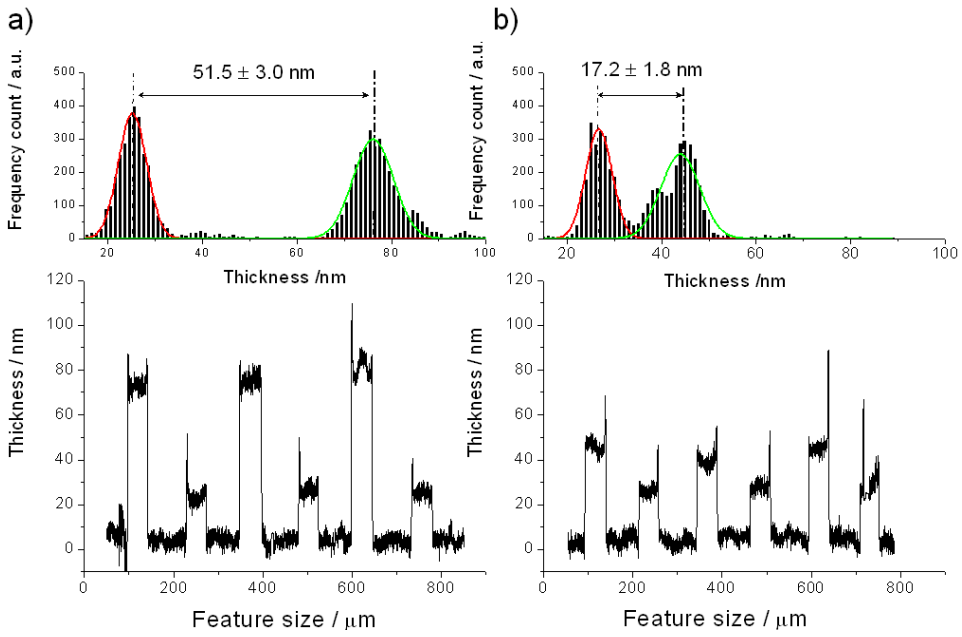


***Figure 1S.*** Thickness analysis of (A) DDPpy film and (B) Ppy film.

The effect of DDPpy thickness was carefully studied. Different potential during electropolymerization (EP) results in different thickness. High voltage results in thick film and dark color. The electrochemical response increases as the thickness increasing, both for specific signal and blank control. However, considering the signal to background ratio (SBR), there exists an optimized thickness for the sensor. Both thick film and thin film have poor SBRs compared with film with appropriate thickness. The relationship between EP, thickness and sensor responses are illustrated in Table 1s. According to the data listed, the optimized condition is chosen as +350 mV / +950 mV in polymerization and the resulting thickness of 51.5 ± 3.0 nm. The optimized condition depends on the geometry and material of the electrode. For each specific electrode, this condition may need to be optimized separately.

***Table 1S***. DDPpy film thickness and sensor response under different electropolymerization

condition

| | Potential in electrochemical polymerization | Thickness (nm) | Current (nA) at 2.5 μg/ml | Current (nA) at blank |
|---|---|---|---|---|
| 1 | +350 mV / +550 mV | 8.4 ± 0.7 | -343.9 ± 11.2 | -10.1 ± 1.5 |
| 2 | +350 mV / +750 mV | 31.3 ± 2.0 | -997.5 ± 28.2 | -12.7 ± 0.8 |
| 3 | +350 mV / +950 mV | 51.5 ± 3.0 | -2260.7 ± 259.9 | -16.8 ± 2.7 |
| 4 | +350 mV / +1150 mV | 108.4 ± 9.4 | -2897.2 ± 391.5 | -233.3 ± 29.1 |

*XPS spectroscopy analysis*:

The XPS measurements were performed in the analysis chamber of an Omicron XPS/UPS system. The base pressure of the chamber is better than $10^{-9}$ mbar. Al Kα (1486.6 eV) was used as the excitation source.

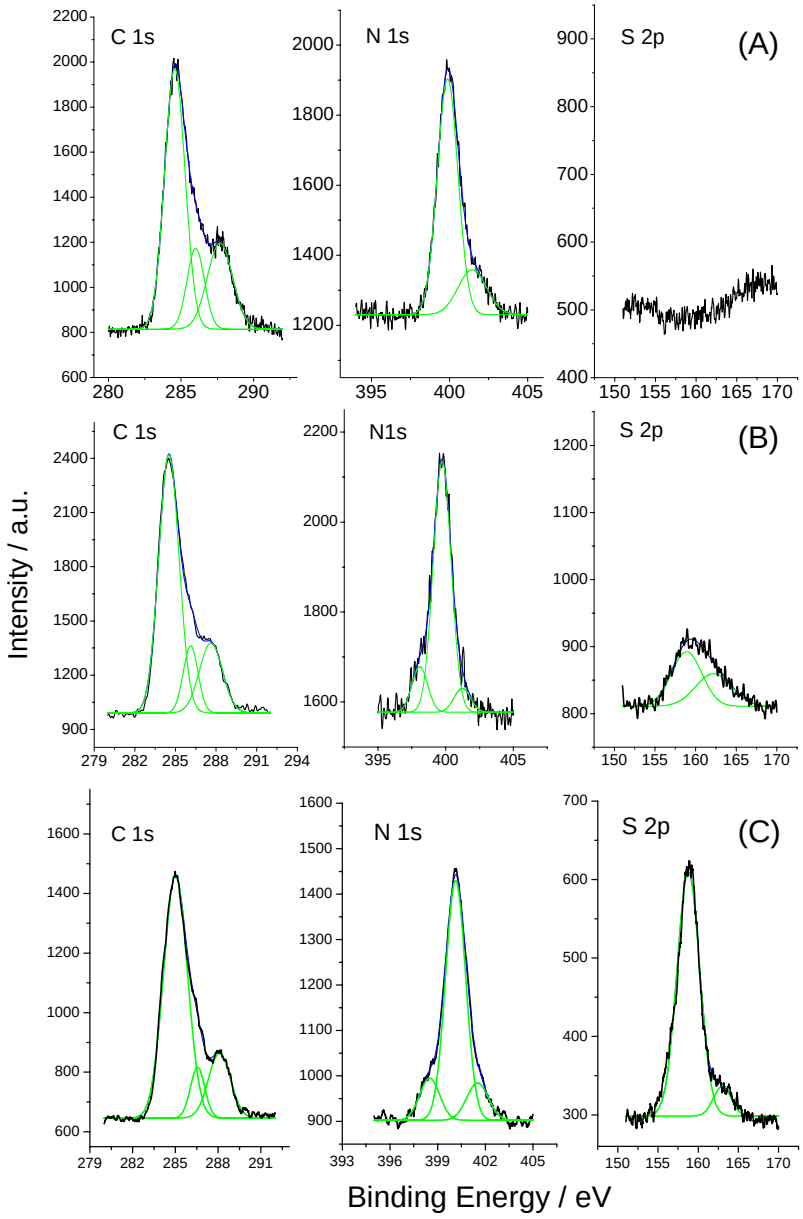


***Figure 2S.*** XPS of (A) Ppy film only (B) DDPpy film only (C) DDPpy film after biotinylated IL-8 antibody binding.

C 1s, N1s and S 2p were observed for three types of polymer films. From the DDPpy

film after protein binding (Fig 2Sc), S2p occupied two peaks at 158.8 eV and 163.5 eV, which are designated to the –SH from the side chain of peptides and –S–S in the protein respecitvely. N 1s exhibits 3 peaks at 398.5 eV (=N–), 400.0 eV (–NH–) and 401.1 eV ($–N^{+}–$). The =N– and –NH– are from the nucleic acid in DNA-dendrimer units. The –NH– and $–N^{+}–$ peaks were most likely contributed by the polypyrrole matrix. This was supported by the 286.6 eV in C1s spectra component. For DDPpy only film, S 2p peak was observed, too, which due to the streptavidin from the DNA dendrimer. The =N–, –NH– and $–N^{+}–$ peaks are also detected in DDPpy film. For Ppy only film, no S 2p signal was detected. The N 2s spectra only show 400.0 eV (–NH–) and 401.1 eV ($–N^{+}–$) which come from pyrrole backbone.