Supplementary Material (ESI) for Analyst
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The Effects of Oligonucleotide Overhangs on the Surface Hybridization in DNA films: An Impedance Study.

Mohtashim Hassan Shamsi and Heinz-Bernhard Kraatz*

Department of Chemistry, University of Western Ontario, 1151 Richmond Street, London, Ontario, Canada N6A 5B7

*Corresponding author's E-mail: hkraatz@uwo.ca

SUPPORTING INFORMATION

Table S1. Values of Randle's equivalent circuit elements for ss-DNA and ds-DNA films. Parentheses show the standard deviation of the measured results.

ID	Strand Type	Rs $k\Omega \cdot cm^2$	CPE 10^{-5} $(S \cdot sec^n \cdot cm^{-2})$	n	R_{CT} $k\Omega \cdot cm^2$	ΔR_{CT} $k\Omega \cdot cm^2$
a	ss-DNA	0.1	4.0 (1.0)	0.82	0.99 (0.4)	
1	ds-DNA	0.1	3.9 (1.0)	0.84	1.35 (0.1)	0.26 (0.1)
2	ds-DNA	0.1	4.0 (1.0)	0.83	1.73 (0.5)	0.74 (0.2)
3	ds-DNA	0.1	3.1 (0.6)	0.86	1.51 (0.5)	0.52 (0.1)
4	ds-DNA	0.1	3.0 (0.4)	0.86	2.35 (0.7)	1.36 (0.1)
5	ds-DNA	0.1	3.4 (0.9)	0.82	1.71 (0.6)	0.72 (0.2)
6	ds-DNA	0.1	2.8 (0.5)	0.84	2.77 (0.7)	1.78 (0.3)
7	ds-DNA	0.1	4.7 (0.7)	0.80	1.98 (0.4)	0.99 (0.2)

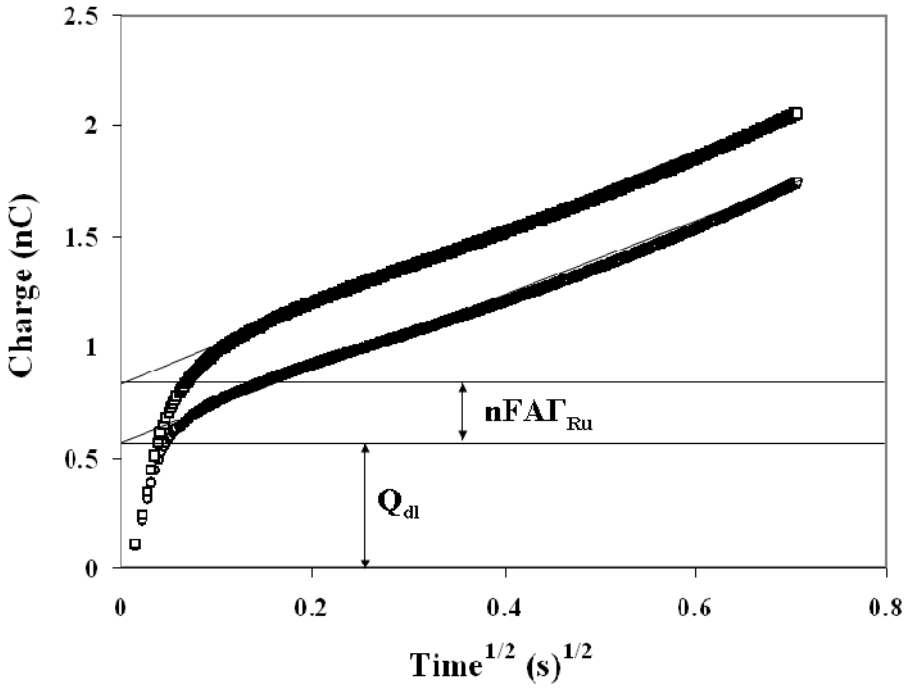

Figure S1. Chronocoulometry plots (charge *vs*. time$^{1/2}$) of ss-DNA capture strand in 10 mM Tris (○) and ss-DNA in 10 mM Tris + 5 μM $Ru(NH_3)_6^{3+}$ (□). Regression lines show the value of charge on Y-axis in absence and presence of $Ru(NH_3)_6^{3+}$.

The total charge passing through the electrode is given by the integrated Cottrell equation [A.J. Bard, L.R. Faulkner, Electrochemical Methods: Fundamentals and Applications, second ed., Wiley, New York, 2001;]:

$$Q = 2nFAC\left(\frac{D}{\pi}\right)^{1/2} t^{1/2} + Q_{dl} + nFA\Gamma_{Ru} \qquad (1)$$

where n is the number of electrons per molecule for reduction, F the Faraday constant (96500 C/mol), A the electrode area (cm^2), D the diffusion coefficient (cm^2/s), C the bulk concentration (mol/ cm^3), Q_{dl} the capacitive charge (C), and $nFA\Gamma_{Ru}$ the charge from the reduction of Γ_{Ru} (mol/cm^2). The Chronocoulometry intercept of the Q *vs.* $t^{1/2}$ plot at t = 0 represents the sum of the charges of double-layer capacitance and the surface-confined species, $[Ru(NH_3)_6]^{3+}$ in this case. By subtracting the capacitive charge (intercept at t = 0

in the absence of redox cation), the total charge of surface-confined $[Ru(NH_3)_6]^{3+}$ were evaluated using following formula.

$$\Gamma_{DNA} = \Gamma_{Ru} (z/m) N_A \qquad (2)$$

where Γ_{DNA} is the capture surface density in molecules/cm^2, m is the number of nucleotides in the probe DNA, z is the charge of the redox molecule, and N_A is Avogadro's number.

Table S3. Calculation for density of DNA on gold surface.

Number of phosphates in each strand ***m***	51
Charge on Ru z	3
Number of electron transfer **n**	1
Calculated Charge $\mathbf{Q_{dl} - \Gamma_{Ru} nFA (nC)}$	0.25
Faraday's Constant **F (C/mol)**	96500
Avagadro's Number $\mathbf{N_A}$	6.02×10^{23}
Area of electrode **A (cm^2)**	2.7×10^{-5}
Density of Ru $\mathbf{\Gamma_{Ru}=Q/nFA (mol/cm^2)}$	6.9×10^{-11}
Density of DNA $\mathbf{\Gamma_{DNA}=\Gamma_{Ru} N_A (z/m) (number/cm^2)}$	2.4×10^{12}