Where is the sodium in self assembled monolayers of single stranded DNA ?

Supporting material

Table 1: XPS results for two types of monolayers made from 15 bases long single strand DNA oligomers containing either 14 adenine and one guanine (1G) or 7 adenine and 8 guanine bases (8G) , after 12 hours adsorption using sodium phosphate buffer. The results are averaged over several take-off angles.

	N/P		N/O		C/P		N/S		% of Na (Na/P * 100%)	
Sample	1G	8G	1G	8G	1G	8G	1G	8G	1G	8G
Theoretical	5	5	1.1	1.01	10.4	10.4	37.5	37.5	-	
Experiment (± 10%)	4.8	4.4	1.63	1.63	15.5	14.2	29	31.5	2.5 %	

Table 2: XPS results for monolayer made from single stranded DNA oligomers containing 15 bases (14 adenine and one guanine) deposited from Mg^{+2} buffer. The take-off angle is 30°.

N/P ±10%	C/P ±10%	N/O ±10%	% of Mg^{+2} (Mg/P* 100%) ±10%
4.2	12.0	0.7	4.8

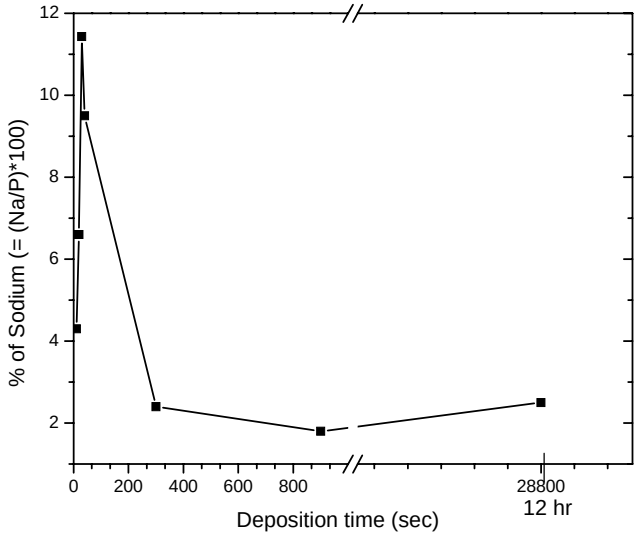

Figure 2: Concentration of Na^+ as a function of adsorption time for a monolayer made from 15 bases long single strand DNA oligomer containing 14 adenine and 1 guanine base.

Film characterization:

The monolayers made from the oligomers shown in Fig. 3 were investigated.

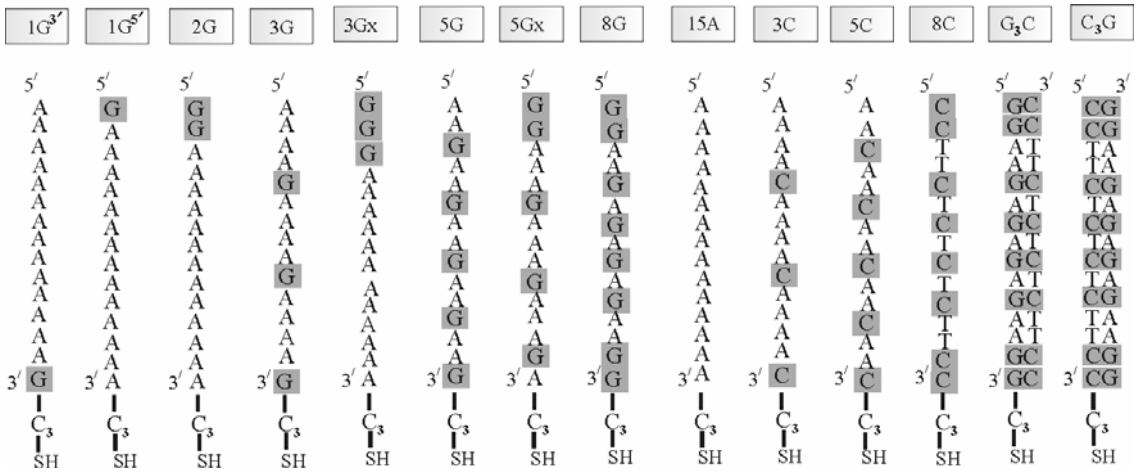

Figure 3: The oligomers that were used for making the self-assembled layer

The thickness of the monolayers made from the different oligomers is shown in Table 3.

Table 3: The thickness of different ds and ss monolayer, after 15 min. adsorption, calculated from spectroscopic ellipsometry for incidence angle θ =70˚

Sample	**1G^3**	**1G^5**	**3G**	**5G**	**8G**	**8C**	**15A**	**5C**	**G$_3$C**
Thickness (Å) ± 2 Å	33	31	30	33	32	30	30	32	37

While the thicknesses of the layers made from single stranded oligomers are all identical within the accuracy of the measurements, the layer made from the double strand (G_3C) is clearly thicker. This finding is consistent with the double stranded DNA being more rigid, while the single strand oligomers are not completely stretched.

Density of the oligomers in the monolayer : Radioactive labeling (^{32}P):

The oligomers were radiolabeled with radioactive phosphate (^{32}P) and then self assembled as monolayer. The density of adsorbed molecules was quantified with phosphoimager. The results are shown in Table 4. The coverage is about the same (~1.4×10^{13}) for all the monolayers, within the error of the radioactive measurements.

Table 4: Coverage calculated from radioactive labeling for different ss and ds DNA monolayers

Sample	**1G**	**3G**	**5G**	**8G**	**8C**	**15A**	**G_sC**
molecules/cm^2 $\times 10^{13} \pm 0.4$	1.5	1.8	1.2	1.7	1.9	0.9	1.1

Average number of molecules is $1.4 \pm 0.4 \times 10^{13}$ molecules/cm^2