Supporting Information

DNA Translocation Through Graphene Nanopores

Grégory F. Schneider, Stefan W. Kowalczyk, Victor E. Calado, Grégory Pandraud, Henny W. Zandbergen, Lieven M.K. Vandersypen and Cees Dekker

As mentioned in the manuscript, we have measured the ionic resistance \( R \) of pores with various diameters \( d \), in monolayer and multilayer graphene. Here, we discuss various ways to fit the data.

We have plotted and fitted the data both as \( R(d) \) and as \( G(d) = 1/R(d) \), which will have the effect of emphasizing the weight of data points at small and large diameters, respectively. We fitted a variety of fitting functions to these data, as indicated in Figure S1. Table S1 displays the resulting fitting parameters as well as the \( \chi^2 \) value, the reduced sum of the squared residuals. From a comparison of these fits, we can note a number of things:

- The trends for comparing different fitting functions are similar when we compare fits to \( R(d) \) with fits to \( G(d) \).

- Most prominently, we observe that the fits to a square dependence on diameter, e.g., \( R \sim 1/d^2 \), are better than fits to a linear dependence, \( R \sim 1/d \).

- When we allow for an offset, the fits improve (\( \chi^2 \) values are lower), which is not surprising since a second fit parameter \( \beta \) is introduced. However, we do not have a good rationale to physically explain such an offset, since we firmly expect \( G(0)=0 \).
- A loglog plot of $G(d)$ shows a straight line, revealing that a power law $G \sim d^{1.6}$ also fits the conductance data quite well. It is, however, unclear to us what type of microscopic model would lead to such power law dependence.

- Finally, a combination of a linear and square dependence, $G(d) = 1/(\alpha/d + \beta d^2)$, also fit the data quite well. We cannot exclude such a crossover dependence which could represent contributions of both the access resistance ($\alpha/d$) and the resistance of a cylindrical pore ($\beta/d^2$).

The final conclusion from the data presented here is that a square dependence fits the data better than a linear dependence on diameter, but we cannot rigorously exclude more sophisticated models.
Figure S1. Ionic resistance $R$ and conductance $G$ for graphene nanopores of various diameters $d$, fitted according to different functional dependences.
Table S1. Fit functions and corresponding fit parameters and $\chi^2$ values obtained for fits to the data presented in Figure S1.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Fitting Parameters</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R(d) = \frac{\alpha}{d}$</td>
<td>$\alpha = 255 \pm 15 \text{ M}\Omega \text{ nm}$</td>
<td>$\chi^2 = 3.7$</td>
</tr>
<tr>
<td>$R(d) = \frac{\alpha}{d^2}$</td>
<td>$\alpha = 2140 \pm 120 \text{ M}\Omega \text{ nm}^2$</td>
<td>$\chi^2 = 2.3$</td>
</tr>
<tr>
<td>$G(d) = \alpha \cdot d$</td>
<td>$\alpha = 4.8 \pm 0.2 \text{ nS/nm}$</td>
<td>$\chi^2 = 8.3$</td>
</tr>
<tr>
<td>$G(d) = \alpha \cdot d^2$</td>
<td>$\alpha = 0.32 \pm 0.02 \text{ nS/nm}^2$</td>
<td>$\chi^2 = 2.0$</td>
</tr>
</tbody>
</table>
| $G(d) = \alpha \cdot d + \beta$ | $\alpha = 7.1 \pm 0.3 \text{ nS/nm}$  
$\beta = -27.1 \pm 0.5 \text{ nS}$ | $\chi^2 = 3.2$ |
| $G(d) = \alpha \cdot d^2 + \beta$ | $\alpha = 0.3 \pm 0.02 \text{ nS/nm}^2$  
$\beta = 5.6 \pm 2.8 \text{ nS}$ | $\chi^2 = 1.4$ |
| $G(d) = d^\alpha$ | $\alpha = 1.58 \pm 0.01 \text{ nS/nm}^w$ | $\chi^2 = 2.6$ |
| $G(d) = \frac{1}{\alpha \cdot \frac{\beta}{d} + \frac{\beta}{d^2}}$ | $\alpha = 0.09 \pm 0.02 \text{ nm/nS}$  
$\beta = 1.8 \pm 0.3 \text{ nm}^2/\text{nS}$ | $\chi^2 = 2.7$ |