

Cite this: DOI: 10.1039/xxxxxxxxxx

Influence of dielectric inhomogeneities on the structure of charged nanoparticles in neutral polymer solutions : Supplementary Information†

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1 Additional Figures

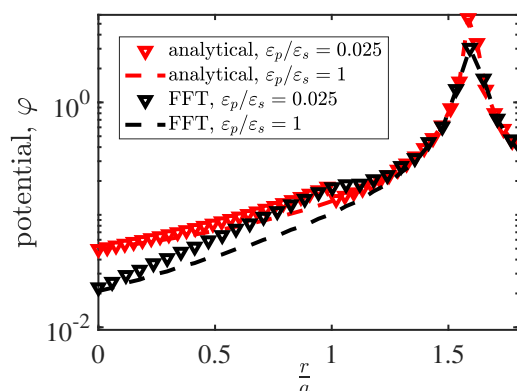


Fig. 1 Comparison of non-dimensional electric potential as a function of distance r along the line joining the center of the sphere and the point charge computed analytically using image methods (Equation 1) and numerically using iterative FFT based solution. The potential is due to a point charge $q = 3.0e$ placed in a medium of dielectric constant ϵ_s at a distance $b = 1.58a$ in front of an uncharged sphere with dielectric constant ϵ_p of radius $a = 26.5\text{nm}$. A cartoon of the setup is shown in Figure 2

dielectric constant ϵ_p is given as follows:

$$\varphi(r, \theta) = ql_b \begin{cases} \sum_{l=0}^{\infty} \frac{\epsilon_s(2l+1)}{\epsilon_s(l+1)+\epsilon_p l} \frac{r^l}{b^{l+1}} P_l(\cos\theta), & \forall r \leq a \\ \sum_{l=0}^{\infty} \left\{ \frac{r^l}{b^{l+1}} + \frac{a^{2l+1}}{b^{l+1}} \frac{(\epsilon_s - \epsilon_p)l}{\epsilon_s(l+1)+\epsilon_p l} \frac{1}{r^{l+1}} \right\} P_l(\cos\theta), & \forall a < r < b \\ \sum_{l=0}^{\infty} \left\{ \frac{b^l}{r^{l+1}} + \frac{a^{2l+1}}{b^{l+1}} \frac{(\epsilon_s - \epsilon_p)l}{\epsilon_s(l+1)+\epsilon_p l} \frac{1}{r^{l+1}} \right\} P_l(\cos\theta), & \forall r \geq b, \end{cases} \quad (1)$$

where θ is the angle $\mathbf{r}$ makes with the line joining the center of the sphere and the point charge, l_b is the bjerrum length (0.7 nm) and P_l is the associated Legendre Polynomial of order l . Overall, the potential for both the ϵ_p/ϵ_s calculated numerically using the FFT based iterative solver closely follows the analytic results for the same.

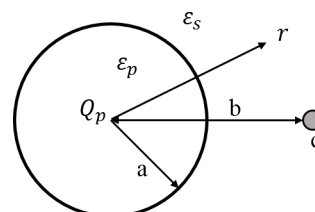


Fig. 2 Model for a charged dielectric sphere of dielectric constant ϵ_p in a medium characterized by the dielectric constant ϵ_s . A point charge q is placed in the medium at a distance b from the center of the sphere.

The analytic expression of the non-dimensional electric potential due to a point charge q placed in a medium of dielectric constant ϵ_s and at a distance b from the center of an uncharged sphere of

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† Electronic Supplementary Information (ESI) available: [details of any supplementary information available should be included here]. See DOI: 10.1039/b000000x/

‡ Additional footnotes to the title and authors can be included e.g. 'Present address:' or 'These authors contributed equally to this work' as above using the symbols: ‡, §, and ¶. Please place the appropriate symbol next to the author's name and include a \footnotetext entry in the the correct place in the list.