The influence of ambient solution on incoherent transport through DNA

K. Herbeć[1] and K. Walczak[1,2]

[1]*Institute of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland*
[2]*School of Electrical and Computer Engineering, University of Virginia*
351 McCormick Road, Charlottesville, VA 22904, USA

There is still no consensus whether pure DNA molecules conduct current or not. Anyway, experiments conducted on DNA in vacuum manifest the conductance zero plateau indicating the band gap size of a few eV, while current-voltage characteristics of DNA in ambient solution (*e.g.* water molecules with ions) reveals Ohmic behavior with no band gap. Here we theoretically examine the effect of counterions on incoherent hole transport through DNA-based junction. Poly(dG)-poly(dC) DNA is treated as a linear chain of quantum dots described within tight-binding approach (only one HOMO level on each guanine is taken into consideration), while decoherence is modeled through the use of imaginary dephasing potential [1]. The fluctuation nature of the counterions is included into our formalism as random changes of site energies and dephasing potentials on each quantum dot as well as random variations of hopping integrals between two neighboring dots. Dimensionless conductance is calculated through the Fisher-Lee formula averaged over many disorder configurations, while the current is computed through the use of the standard Landauer expression [2].

---

[1] K. Walczak, phys. stat. sol. (b) **244** (2007) 1088
[2] J. Yi, B.J. Kim, Phys. Rev. B **75** (2007) 035111

Name of the presenting author (poster session I): Krzysztof Herbeć
e-mail address: walczak@amu.edu.pl
http://www.staff.amu.edu.pl/~walczak