Electrochemical Characterization of DNA Attachment on Graphitic Carbon Microelectrodes for BioNanoelectroics Platforms

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Over the past several years, there has been an increase in interest in investigating potential technologies that will eventually replace silicon as a basis for electronic components as feature sizes go below 10 nm. One of these technologies involves DNA molecular wires which are typically 2nm in diameter and have some reported semi-conductor properties. We have recently demonstrated DNA molecular wires and ropes covalently attached to both metal as well as graphitic carbon (derived from polymer pre-cursor) microelectrodes and established that they offer semi-conductor behavior. I-V characterizations as well as AC impedance results indicate that DNA (λ-DNA in our case) has conductivity similar to typical semi-conductor materials but with AC impedance response typical of metal structures. In this report, we further investigate this property through electrochemical impedance spectroscopy and cyclic voltammetry. We report on the effect of the DNA sequence and length, electrode material, and substrate on the electrical and electrochemical responses.