Electrochemical impedance spectroscopy for graphene surface modification and protein translocation through the chemically modified graphene nanopore

PURUSHOTTAM TIWARI, YUPING SHAN, XUEWEN WANG, YESIM DARICI, JIN HE, Department of Physics, Florida International University, Miami, FL 33199 — The multilayer graphene surface has been modified using mercaptohexadecanoic acid (MHA) and 1,2-dimyristoyl-sn-glycero-3-phosphoethanolamine-N-[methoxy(polyethylene glycol)-750] (DPPE-PEG750). The surface modifications are evaluated using electrochemical impedance spectroscopy (EIS). EIS measurements show the better graphene surface passivation with DPPE-PEG750 than with MHA. After modification with ferritin, the MHA modified surface shows greater charge transfer resistance ($R_{ct}$) change than DPPE-PEG750 modified surface. Based on these results the translocations of ferritin through modified graphene nanopore with diameter 5-20 nm are studied. The translocation is more successful through DPPE-PEG750 modified graphene nanopore. This concludes that the attachment of ferritin to DPPE-PEG750 modified graphene nanopore is not significant compared to MHA modified pore for the ferritin translocation hindrance. These results nicely correlate with the EIS data for respective $R_{ct}$ change of ferritin modified surfaces.

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Purushottam Tiwari
Department of Physics, Florida International University, Miami, FL 33199

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