Graphene plasmonics nanopores for DNA sequencing

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Solid-state nanopores are a promising technique for rapid, low cost and accurate sequencing of long DNA fragments. However, two huge challenges are faced. First, the fabrication of nanopores through TEM drilling is an expensive and intensive process. Second, the high DNA translocation speed through the nanopore are currently too quick for measurement resolution. By coupling the graphene nanopore with an optical antenna, we are able to localized the formation of a nanopore through a laser induced dielectric breakdown. Following the breakdown process, the same bowtie antennas also induces large optical gradients which allow us to arrest or stall the motion of a translocating DNA[1]. By coupling graphene with a optical antenna, we demonstrate through FDTD simulations that we are able to create highly confined field intensities at the edge of the nanopore for interaction with the DNA. Moreover, these simulations show that the plasmonic response of graphene can be tuned – unlike conventional plasmonics stucturues with fixed responses after fabrication.

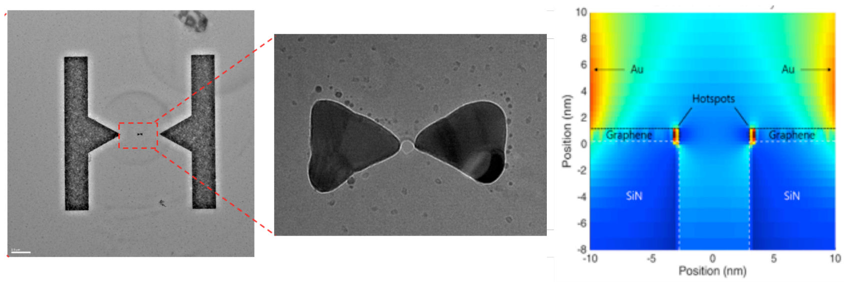

Fig. 1 *Graphene Plasmonics Nanopore. Left to Right: 1) TEM image of fabricated graphene plasmonics nanopore with alignment marks for optically induced dielectric breakdown 2) Close up of graphene nanopore produced by TEM drilling 3) Side view of Lumerical simulation of optical hotspots.*

References

[1] Belkin, Maxim, et al. "Plasmonic nanopores for trapping, controlling displacement, and sequencing of DNA." *ACS nano* 9.11, 10598-10611. (2015)