Label-free detection of DNA hybridization and single point mutations in a nano-gap biosensor

Rosa Letizia Zaffino, Mònica Mir, Josep Samitier

Ibec, C/Baldiri I Reixac 10-12 08028, Barcelona, Spain
rlzaffino@ibecbarcelona.eu

Abstract We describe a conductance-based biosensor that exploits DNA-mediated long-range electron transport for the label-free and direct electrical detection of DNA hybridization. This biosensor platform comprises an array of vertical nano-gap biosensors made of gold and fabricated through standard photolithography combined with focused ion beam lithography. The nano-gap walls are covalently modified with short, anti-symmetric thiolated DNA probes, which are terminated by 19 bases complementary to both the ends of a target DNA strand. The nano-gaps are separated by a distance of 50nm, which was adjusted to fit the length of the DNA target plus the DNA probes. The hybridization of the target DNA closes the gap circuit in a switch on/off fashion, in such a way that it is readily detected by an increase in the current after nano-gap closure. The nano-biosensor shows high specificity in the discrimination of base-pair mismatching and does not require signal indicators or enhancing molecules. The design of the biosensor platform is applicable for multiplexed detection in a straightforward manner. The platform is well-suited to mass production, point-of-care diagnostics, and wide-scale DNA analysis applications.

References

[1] R L Zaffino *et al* 2014 *Nanotechnology* **25** 105501 doi:10.1088/0957-4484/25/10/105501

Figures