GRAPHENE-BASED PLASMONIC INTERFACES

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Graphene coated plasmonic interfaces have been theoretically and experimentally investigated as alternative SPR surfaces.[1] The advantages of graphene-based SPR surfaces are the high surface-to-volume ratio which has proven to be beneficial for efficient adsorption of biomolecules when compared to gold and possible π-stacking interactions between the carbon-based ring structures of organic and biological molecules and the hexagonal cells of graphene. This strong interaction of biomolecules is, however, a major limitation of graphene-based SPR sensors due to the lack of specificity of these interfaces.

In this presentation, different strategies (electrophoretic deposition, mechanical transfer, etc) for the formation of graphene-coated SPR interfaces will be presented and their respective advantages/disadvantages discussed.[1-3] The resulting SPR surfaces were used for the detection of lysozyme, an enzyme that hydrolyses the polysaccharide walls of bacteria. Increased concentrations of lysozyme in urine and serum are associated with leukemia and renal diseases. The exact determination of lysozyme concentrations is thus of clinically importance. It will be further shown that such SPR interfaces are alternative platforms for the screening of pathogens and for the understanding of bacterial adhesion parameters.

References :

1. Szunerits, S.; Maalouli, N.; Wijaya, E.; Vilcot, J. P.; Boukherroub, R., *Anal. Bioanal. Chem.* **2013,** 405, 1435.
2. Subramanian, P.; Lesniewski, A.; Kaminska, I.; Vlandas, A.; Valsilescu, A.; Niedziolka-Jonsson, J.; Pichonat, E.; Happy, H.; Boukherroub, R.; Szunerits, S., *Biosensors and Bioelectronics*, **2013** ,50, 239-243
3. Subramanian, P.; Barka-Bouaifel, F.; Bouckaert, J.; Yamakawa,[N.;] Boukherroub, R.; Szunerits, S .; *ACS App. Mater. Inter*., **2014**, accepted

Preparation and applications of chemically reduced graphene oxide

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Graphene has attracted a great deal of scientific and technological attention in recent years due to its remarkable electronic, mechanical and thermal properties. Due to its low cost of production, large specific surface area and abundant surface chemistry, reduced graphene oxide (rGO) has shown great promise in the development of novel composites, biosensors and catalysts.[1,2] rGO has been shown to be an effective biosensing interface of different biomolecules and biologically relevant molecules such as H_2O_2, glucose, dopamine, ascorbic acid, uric acid, protein, DNA, cholesterol, histidine, organosulphate pesticides, nicotinamide adenine dinucleotide (NADH), etc.[3,4]
Despite the many potential applications that rGO promises to offer, one of the major challenges remains the development of controlled functionalization schemes of rGO. Chemical modification of rGO enhances its solubility, but also allows the electronic properties of the material to be controlled. Both covalent and non-covalent strategies have been used for graphene functionalization.[5]
In this presentation, I will focus on the different strategies for the preparation of functionalized reduced graphene oxide and subsequent utilization of the material for different applications such as sensing, catalysis and energy storage.[6-20]

(1) Novoselov, K. S.; Geim, A. K.; Morozov, S. V.; Jiang, D.; Zhang, Y.; Dubonos, S. V.; Grigorieva, I. V.; Firsov, A. A., *Science* **2004,** 306, 666-669.
(2) Allen, M. J.; Tung, V. C.; Kaner, R. B., *Chemical Reviews* **2009,** 110, 132.
(3) Kuila et al. *Biosensenors &. Bioelectronics*, **2011**, 26, 4637.
(4) Shao, Y.; Wang, J.; Wu, H.; Liu, J.; Aksay, I. A.; Lin, Y. *Electroanalysis*, **2010**, 22, 1027.
(5) Liu L.-H.; Yan, M. *Journal of Materials Chemistry* **2011**, 21, 3273.
(6) Kaminska *et al. Chemical Communications* **2012**, 48, 1221-1223.
(7) Kaminska *et al. ACS Applied Materials & Interfaces* **2012**, 4, 5386-5393
(8) Kamińska *et al. ACS Applied Materials & Interfaces* **2012**, 4, 1016-1020
(9) Kamińska *et al. Chemistry - A European Journal* **2013**, 19, 8673-8678
(10) Oprea *et al. Analyst* **2013**, 138, 154345-4352
(11) Subramanian *et al. Biosensors & Bioelectronics* **2013**, 50, 239-243
(12) Perry *et al. Lab On a Chip* **2012,** 12, 1601-1604
(13) Perry *et al. Journal of Materials Chemistry A* 1 (**2013**) 12355-12360
(14) Wang, Q. *et al. Bioelectrochemistry* **2013**, 93, 15-22
(15) Barras *et al. Applied Catalysis B: Environmental* **2013,** 130– 131, 270– 276
(16) Szunerits *et al. Analytical and Bioanalytical Chemistry* **2013,** 405, 1435-43
(17) Das *et al. Colloids and Surfaces B: Biointerfaces* **2013,** 105, 128–136
(18) Wang, Q. *et al. Electroanalysis* **2014**, 26, 156-163
(19) Wang, Q. *et al. Carbon* **2014**, 68, 175-184
(20) Kumar *et al. RSC Advances* **2014,** 4, 10420-10423