NANOSCIENCE COLLOQUIUM

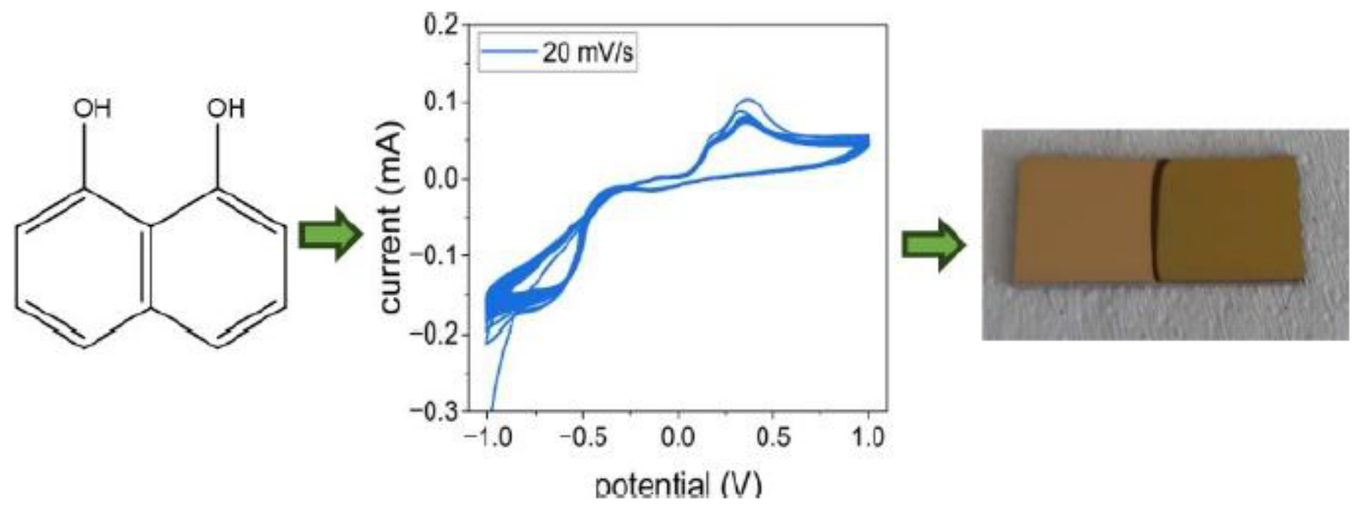
Polydopamine based coatings and nanomaterials Design of carbon-based functional materials from allomelanin precursors with dual anti-oxidant, anti-bacterial and other properties

Prof. Dr. Vincent Ball

Joint research unit, «Biomaterials and Bioengineering», French National Institute of Health and Medical Research & Faculty of Dental Surgery, University of Strasbourg

ABSTRACT:Up to the last years, surface functionalization of materials relied on specific chemistry : for example self-assembled thiol based monolayers on noble metals, silane chemistry on oxydes, the surfaces of hydrophobic polymers being the most difficult to funtionalize. However, the biomimetic chemistry paradigm introduced by Lee and Messersmith in 2007 revolutionized surface science in aqueous solution by using redox chemistry of catecholamines [1]. This chemistry relying on the oxidation of catecholamines (dopamine, norepinephrine, L-DOPa) allows to functionalize the surface of almost all known materials. This chemistry and its engineering will be reviewed in this presentation as well as its drawbacks and ongoing improvements [2]. Some applications concerning the deposition of dopamine based films at the water/air interface and inside the pores of membrane proteins will be presented [3].

Finally, the electrodeposition from nitrogen free polyphenols (scheme) to yield thick, sometimes cristalline graphene oxide like films, porous, antioxydant and antibacterial films will be described [4].



Scheme : electrodeposition on gold substrates of allomelanin based film from 1,8-dihydroxynaphtalene solutions.

[1] LEE, H.; DELLATORE, S.M., MILLER, W.M; MESSERSMITH, Ph. Science, 2007, 318, 426-430.
[2] BALL, V. ; HIRTZEL, J. ; LEKS, G. ; FRISCH, B. ; TALON, I. Macromol. Rapid Comm. 2023, 44, art. 2200946.
[3] NEVESHKIN, A.; CITAK, F.; BALL, V.; WINTERHALTER, M. Polydopamine coating to stabilize lipid bilayer for channel sensing. Langmuir 2017, 33, 7256-7262.
[4] ZIEGLER, K.; BOECKER, M.; BALL, V.; SANCHEZ, C.; BOISSIERE, C.; ERSEN, O.; IHIAWAKRIM, O.; KISSMANN, A.-K.; MARCHESI d'ALVISE, T.; MOSER, J.; ROSENAU, F.; WEIL, T.; SYNATSCKE, C. Langmuir, 2025, 41, 3971-3985.

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