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Protein interaction with AgNPs-based plasma deposited nanocomposites: An excellent strategy to reveal the protein-adsorption problem

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Protein-adsorption problem on solid surfaces remains an active field of academic research due to its imoprtance for various industrial and biomedical applications representing the conditioning step of micro-organism adhesion and biofilm formation. Alternatively, nanomaterials and specifically nanocomposite thin layers became indispensable components in bioanalytical devices, since they clearly enhance their performances in terms of sensitivity and detection limits down to single molecules. However, rational engineering of the nanocomposites is mandatory in order to properly design their structural, optical and electrical properties. It thus opens the way for transition from material level of development to system level of applications. In this work, we exploit the multifunctionality of silver nanoparticles (AgNPs) as plasmonic antenna when embedded at a controlled nanometric distance from the free surface of thin SiO_2 layers (called plasmonic substrates) and as biocide agents because of their strong toxicity towards micro-organisms to study the protein-adsorption problem. The coupling of AgNPs and Discosoma red fluorescent proteins (DsRed), that displays exceptional photo-stability, is proposed as an appropriate strategy to study the protein-adsorption problem on solid surfaces. To that end very thin DsRed protein layers were deposited on the plasmonic structures. The Raman spectra of the DsRed thin layers, not visible in absence of AgNPs, have been detected and analyzed owing to Surface Enhanced Raman Scattering (SERS). It was found that the DsRed proteins undergo conformational changes after adsorption on the plasmonic substrates. Three different DsRed chromophore configurations were identified and a scenario of the protein temporal evolution was proposed.

Biography

K Makasheva is a Researcher at CNRS, LAPLACE laboratory, Toulouse, France with a PhD degree in Plasma Physics from Sofia University, Bulgaria, 2002, for her work on surface wave sustained plasmas. Her research activities in LAPLACE are directed to design and study of plasma deposited nanostructured materials for biomedical, optical and electrical engineering applications. She is the author and co-author of over 60 publications in international journals. Recently, she served as General Chair of the 11th IEEE Nanotechnology Materials and Devices Conference (IEEE NMDC 2016) in Toulouse.

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