Surface functionalization and antibacterial surfaces

Nanotechnology involves the understanding and control of matter at dimensions between 1-100 nanometers. As a consequence of geometry the surface/volume ratio of an object increases as the object becomes smaller. The progression of many aspects of science and technology into the nanoscales and "all surface" realm results in the greater importance of surfaces. It is well known today that nanostructures, nanotextures and the chemical composition of the surface are the most crucial factors that determine how the environment responds in the presence of a material. It has become one of the most challenging tasks to modify the surface of materials (alloys, composites, polymers, metals, semiconductors etc.) in order to bring physical, chemical and biological properties making them ideal for specific applications. In this work we describe the inducible expression and the *in-vivo* biotinylation of Green Fluorescent Protein - His tag, recombinant protein using the E.Coli BL21 as the heterologous host expression system. Substrates ranging from Si, SERS active substrates and chitosan capped Au nanoparticles, to polymeric substrates e.g. pet and cellulose acetate nanofibers will be modified in order to be able to introduce the biotinylated GFP on the surfaces successfully. The materials mentioned above cover an application spectrum ranging from electronics and biosensors to tissue engineering. Surfaces will be treated with PEI which introduces free amino groups on the surface, therefore making it possible for the NHS-ester derivative (biotin-NHS-ester) to react with the aminated surfaces. Using the high affinity structure biotin-streptaviding-biotinylated protein will introduce molecules of GFP protein on the surface. The result of the aforementioned modification will be tested using confocal microscopy. As a second part of this work we will test the antibacterial effect of Ag. The different antibacterial effect of the layer of Ag/Si and the nanoparticles of Ag, AgNP/Si will be tested against gram positive and gram negative bacteria. The antibacterial effect will be tested and discussed in terms of the inhibition zone of bacterial growth.