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Multifunctional nanodiamond surfaces functionalization for developing

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Since 9/11 attack and the deaths from anthrax contamination, bio-safety issues have become prominent. Food safety, on the other hand, especially with regard to foodborne pathogens, is another important issue. Therefore, the rapid or real time detection of pathogens becomes extremely important for the food industry as well as homeland security. Among the family of advanced carbon materials, diamond is of great interest owing to their several unsurpassable physical (mechanical, electrical, thermal, and chemical/biological inertness) properties for various applications. In this work, the potential of the diamond surfaces in the development of next generation 'smart' biosensing platforms have been investigated and we have used three variants of diamond surfaces: nanodiamond, ultradispersed diamond and adamantane. Our goal is to immobilize the antibodies and bacterial (bio-molecules) binding on the plasma modified diamond surfaces to increase their efficacy as potential biosensors by researching the antibody-antigen binding to increase detection and sensitivity. The efficiency of the bio-functionalization will be assessed through various complementary structural and optical tools: electron and inverted optical microscopy, fluorescence emission and Raman spectroscopy, and UV/Vis. The present work will discuss our findings in terms of: a) the significance of nanodiamond surfaces and plasma treatment; b) the efficacy and efficiency of covalent binding of biomolecules and c) the specificity of antibodies which may enhance the efficiency of bio-detection through uniform distribution. This work is supported in parts by internal BBC MU and S. Gupta's startup funds.