

## **SURFACE ANALYSIS: FROM SINGLE CRYSTALS TO BIOMATERIALS**

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Surface analysis plays an important role in a wide range of research and development areas such as catalysis, biomaterials, microelectronics, clean energy and corrosion. The toolbox of surface analysts allows us to easily move across research topics and make significant impacts in both industrial and academic settings. The typical surface analyst is an expert in multiple techniques, surface modification, sample preparation/handling and instrumentation. However, we have all benefited from the significant and numerous advances that have occurred in the past 40 years in terms of improved instrumentation, introduction of new techniques and development of sophisticated data analysis methods, which has allowed us to perform detailed analysis of increasingly complex samples. For example, comprehensive analysis of surfaces and surface immobilized molecules with modern surface analysis instrumentation provides an unprecedented level of detail about the immobilization process and the structure of the immobilized molecules. Results from x-ray photoelectron spectroscopy (XPS), time-of-flight secondary ion mass spectrometry (ToF-SIMS), near edge x-ray absorption fine structure (NEXAFS), surface plasmon resonance (SPR) and quartz-crystal microbalance with dissipation (QCM-D) biosensing, atomic force microscopy, and sum frequency generation (SFG) vibrational spectroscopy combined with computation methods such as molecular dynamic (MD) and Monte Carlo (MC) simulations provide important information about surface chemistry and structure. However, even with the advances that have been achieved with these powerful surface analysis techniques, there still remain many significant challenges for surface analysis. These include characterizing the surface chemistry and structure of nanoparticles, determining the atomic level structure of complex molecules bound to surfaces, 3D imaging of samples, and improved sample preparation methods that maintain materials in a relevant state when using ultra-high vacuum based analysis techniques.

This talk will discuss my adventures as a surface scientist/analyst starting from chemisorption and reactivity studies of small molecules on single crystal surfaces followed by industrial catalysis research and eventually moving to biomedical surface analysis with side ventures into areas such as clean energy. It has been an exciting journey and I will use it to provide some examples of multidisciplinary role of surface analysis as the field has advanced.