

2D Materials Analysis Using Multi-techniques (XPS, Raman & SEM)

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Materials science has seen substantial progress over the last decades, driven by technological developments in materials synthesis, characterization, and applications. Ultra-thin films, 2D materials, and functionalized systems often exhibit complex chemistry, which demands detailed characterization using multiple analytical methods. To increase confidence in imaging and surface analysis results, it is advantageous to perform measurements at the same position across techniques.

The Correlative Imaging and Surface Analysis (CISA) workflow is a comprehensive approach that combines multiple analytical techniques to deliver a detailed understanding of surface properties and composition. This method is particularly useful in materials science, nanotechnology, and other fields where robust surface characterization is crucial. The workflow is based on dataset alignment, enabling point-of-interest correlations to be established between XPS and SEM through precise positioning. This improves the accuracy of the correlation and allows the datasets to be merged seamlessly.

X-ray Photoelectron Spectroscopy (XPS) is a surface-sensitive characterisation technique that provides elemental quantification and chemical information from the top ~10 nm of a material. This capability is essential for understanding surface properties and near-surface chemistry. In addition, XPS can provide elemental and chemical information through the bulk of materials via depth profiling when coupled with monoatomic and gas cluster ion sources (MAGCIS). Depth profiling is particularly important for interface analysis and the characterisation of layered materials.

Raman spectroscopy can also be combined with XPS to provide complementary chemical characterization, especially for assessing the quality and structure of 2D materials. This combination becomes even more effective when the focal points of XPS and Raman are aligned, allowing both datasets to be acquired from the same point and compared directly.

Overall, combining SEM and XPS alongside Raman spectroscopy enables a more comprehensive understanding of advanced materials, including 2D and functionalized materials. In this presentation, we will discuss the advantages of this combined approach and highlight examples from a range of applications.