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Correlative surface microscopy for healthcare technologies

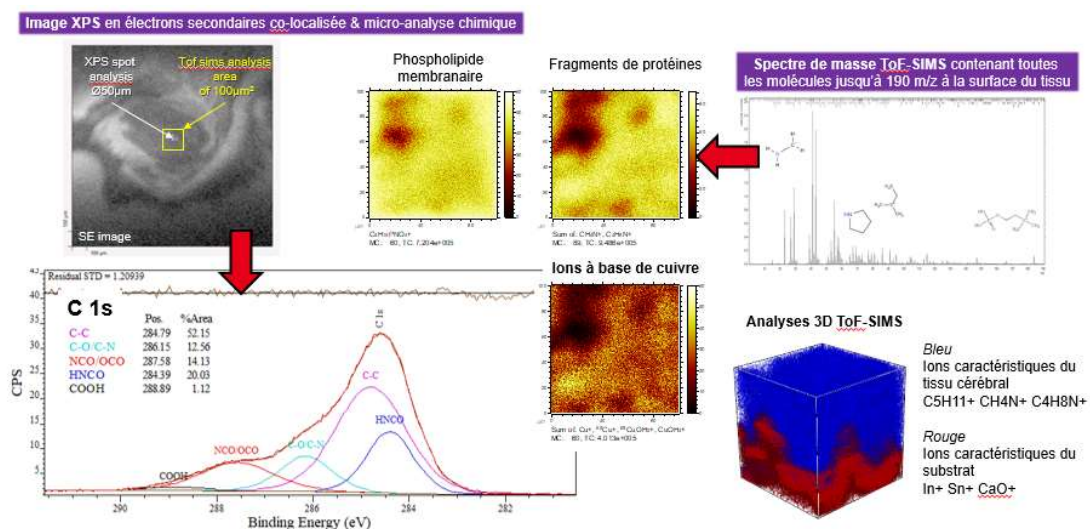
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With the rapid developments of healthcare technologies over the past years and the fabrication of implantable medical devices it is becoming more and more important to control the critical interfaces between synthetic materials and biological objects or tissues [1]. To this end, one of the trend is the application to biological samples of analytical surface-sensitive methods traditionally dedicated to surface physics and chemistry, such as time-of-flight secondary ion mass spectrometry (ToF-SIMS) and photoemission-based methods. The latter ones include scanning X-ray photoelectron spectroscopy (μ -XPS) and X-ray photoemission electron microscopy (XPEEM). Recently these techniques were successfully applied to biological systems, from individual cells to tissues [2-4]. Here, we have combined these spectroscopic and imaging techniques on the same sample in order to provide a comprehensive, multi-scale chemical analysis of the molecular and bonding states. This approach is illustrated by the study of a fibrotic tissue formed after a neural device implantation [5]. In this example, ToF-SIMS highlights molecular contrasts over a 100- μm field of view between relevant regions related to phospholipid membranes and extra-cellular matrices, while μ -XPS provides elemental and chemical quantification at a similar scale. XPEEM provides further refinements by confirming at the micron-scale this molecular and chemical differentiation, with possible implications in the understanding of inflammatory processes involved in neural device implantation.

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