Scilight

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Time-of-flight spectrometry of biointerfaces helps link deposition mechanisms to surface design

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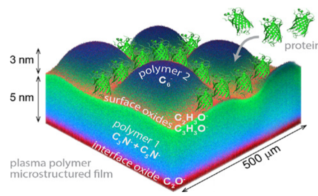
An up-and-coming spectrometry technique helps reveal how the composition of plasma polymer films affects biofunctionality, and how the dynamics of film deposition mechanisms plays a role in creating particular surface features.



Plasma polymer films are promising biointerface materials with applications for future tissue engineering, biosensing and more. To optimize film functionality, such as protein binding, it's necessary to understand how the competing mechanisms during the deposition of reactive species on the surface of materials affect their chemical characteristics.

As they report in *Biointerphases,* scientists applied Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) to demystify this link between deposition and functionality. They found that ToF-SIMS could not only detect subtle cross-linking and chemical differences between films, but also distinguish between the different mechanisms involved during the deposition. Expanding on this, they designed a variety of different amino- and carboxylic acid-based bilayer polymer film microstructures using different deposition strategies and analyzed them with various ToF-SIMS operation modes.

The researchers performed ultrashallow depth-profiling on bilayers down to only a few nanometers in depth. This profiling revealed vertical chemical gradients at layer interfaces of various shape and extent, depending on the chosen deposition strategy.

Imaging of microstructured films, designed with biological and biosensing applications in mind, featured specific attachment points for biological compounds like proteins, including lateral chemical gradients between adjacent structures.

The 3-D analysis, obtained by combining profiling and imaging modes, offers an unprecedented amount of detail about the interlayer and lateral gradients. With such a full molecular picture of the microstructures, along with results from more conventional analysis of macroscopic surface properties (like hydrophilicity), the authors link dynamics of deposition mechanisms with their resulting surface properties and provide a method of interpreting site-specific protein binding results.

Co-author Laetitia Bernard envisions that their demonstration of ToF-SIMS as a powerful and robust technique will enable more directed film design. "For the plasma polymer film community this work will open a new route for further development of films," she said.

Source: "Plasma polymer film designs through the eyes of ToF-SIMS," by Laetitia Bernard, Patrick Rupper, Greta Faccio, Dirk Hegemann, Olivier Scholder, Manfred Heuberger, Katharina Maniura-Weber, and Marianne Vandenbossche, *Biointerphases* (2018). The article can be accessed at https://doi.org/10.1116/1.5016046.