PROJECT FACTSHEET

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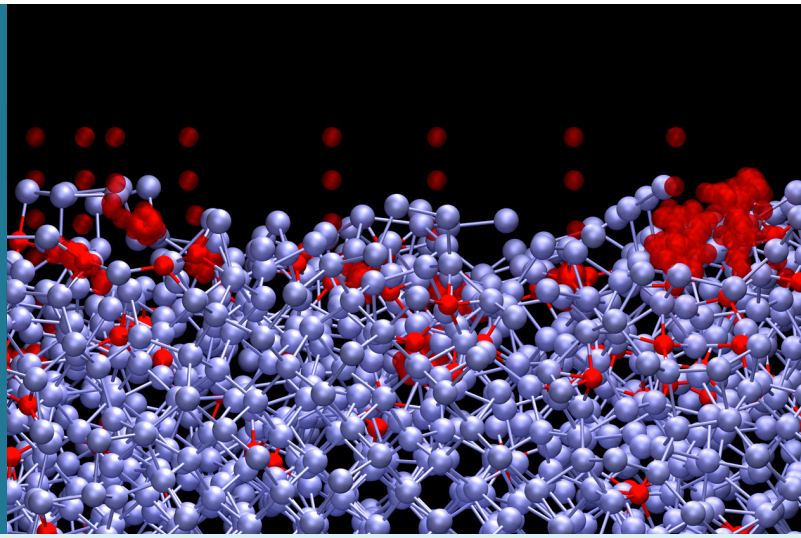
ULOWBEAM

Define the experimental conditions for a better characterization of the material's composition & structure on a very small scale based on a process using ultra-low energy ion beams



Inspiration

In our environment, nanotechnologies are increasingly present. As miniaturization of technology progresses, it is crucial to better characterize nanometre-sized devices and to see how materials interact on this small scale. In this context, as an example, it is important to find out if nanomaterials are capable of penetrating biological cells, or even affect their nature.
To answer such questions, it is essential to possess effective capabilities for the characterization of devices on a very small scale. However, current commercial tools and processes have numerous limitations that absolutely need to be overcome.

Innovation

The characterization of nanometre-sized objects often uses a process based on ion beams. These are projected with high energy onto a sample surface for its analysis by sputtering the atoms from this surface, the species of the latter being revealed by mass spectrometry. While this process allows for imaging the surface of the material with high lateral resolution, it does not allow to determine the chemical composition with high depth resolution. The high impact energy of the ion beam causes significant damage to the sample surface, leading to some atomic mixing down to a depth of several tens of nanometres, modifying both composition and properties of the original material.
In order to minimize the damage to the material during analysis and to allow for high lateral and depth resolution at the same time, a method making use of low-energy ion beams is proposed. However, if perfect vacuum conditions cannot be created (e.g. some residual water vapour remaining in the chamber of the instrument), the impact of analysis conditions on results will become more important with decreasing impact energy, leading to some erroneous determination of the sample composition.
Within the ULOWBEAM project, LIST teams aim to develop a model which will allow for a better understand how the environment impacts analysis results for sputtering by low-energy ions (<500 electronvolt). With its partner, it will determine the experimental conditions for a successful analyses with ultra-low energy ion beams for applications in nanoscience. To achieve this, the teams will use a multidisciplinary approach combining experimental and numerical methods.

Impact

At the end of the project, the partners expect to have a better knowledge of the influence of the environment on the analyses with low-energy ion-beams. The results obtained will allow them to propose technical recommendations allowing atomic- or molecular-scale materials to be studied both with high lateral and depth resolution.
With better tools and processes for materials characterization, it will be possible to understand how the nano-objects interact with their environment, for example for the purpose of preventive healthcare or guaranteeing the properties and performance of manufactured materials.

Partners

Thermo Fisher Scientific (USA)

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