

## Using the Helium Ion Microscope for Imaging and Modification of Nanostructures, 2D Materials, and SARS-CoV-2 Infected Cells

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The Helium Ion Microscope (HIM) utilizes a focused beam of helium ions to image and modify materials with high spatial resolution, large depth of field, and chemical sensitivity [1]. HIM images show stronger chemical and topographical contrasts than images from the related scanning electron microscope, and the HIM is capable to resolve sub-nanometer features. Due to its charge compensation capability, the HIM can image insulating biological samples without additional conductive coatings. My presentation will contain examples of HIM imaging of nanomaterials, like 1 nm thick carbon nanomembranes (CNMs), 2D materials, and biological cells [2]. In an exploratory HIM study of SARS-CoV-2 infected Vero E6 cells, interactions between cells and virus particles, as well as among virus particles, could be imaged [3]. The HIM pictures show the three-dimensional appearance of SARS-CoV-2 and the surface of Vero E6 cells at a multiplicity of infection of approximately 1 with great morphological detail. The absence of a conductive coating allows a distinction between virus particles bound to the cell membrane and virus particles lying on top of the membrane. When applying higher ion currents, the HIM can be also used for the modification of materials. The capability of the HIM for nanolithography will be shown by milling 2D materials, where nanopores with diameters down to 1.3 nm were fabricated [4].

### References:

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