In this work we present the concept of ‘Correlative Tomography’ which represents a major step forward in the level of information that can be brought to bear on a region of interest across multiple scales. The benefit of multiscale information is to find relevant areas of interest in large volumes for high resolution studies and to prove that these high spatial resolution results are representative for the macroscopic sample. Despite the rapid advance in 3D imaging techniques existing work to date has principally registered 2D images to 3D volumes, or linked populations measured at different scales in a statistical manner. We present the integration 3D datasets from the macro to the nanoscale where the location of each new scale and modality of imaging is specifically targeted using the information from the previous scale/technique. Our example study combines macroscale X-ray tomography, high resolution X-ray tomography, focussed ion beam serial sectioning with scanning electron microscope imaging, electron backscatter diffraction and scanning transmission electron microscopy with additional energy dispersive X-ray spectroscopy all combined and spatially linked through a single workflow ensuring connectivity of the resultant data. In this way we have been able to go right to the heart of the matter by identifying the competition between the different corrosion mechanisms at play in several example materials including corrosion of stainless steel, creep cavitation in stainless steel and stress corrosion cracking in 7000 series aluminium. Through these examples we have revealed new insights in mature fields and we feel that correlative tomography as a technique will also bring significant insights to biological and geological sciences.
Fig. 1: Figure showing a region of interest identified from a virtual slice of the reconstructed X-ray CT data. A SEM image of the same region prepared by the FIB for extraction of a TEM sample and lastly a HAADF image and chemical maps of Fe, Cr, Ni and C of the same region recorded in the TEM.