Evaluation of the XTM setup at the P05 Imaging Beamline at PETRA III using a sample of Nanoporous gold

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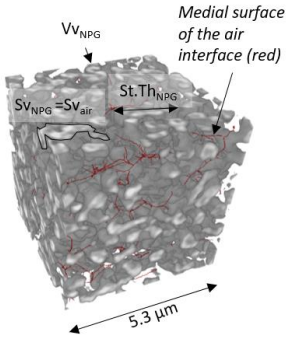

Nanoporous gold (NPG) is the structure resultant from dealloying an Ag-rich AgAu alloy. It displays a high specific surface area, high electrical conductivity and good mechanical properties, making it very interesting for sensing and actuating applications [1]. The structural length-scales of NPG can be tailored to different structural thicknesses ranging from 20 nm up to 1 µm, which allows a tailorable mechanical response [2]. Recent Focused Ion Beam (FIB) based tomography measurements have identified critical topological characteristics shown to correlate to mechanical response [1-2]. However, the destructive nature of the method negates the possibility to investigate the evolution of the network structure with deformation. X-ray Tomographic Microscopy (XTM) on the other hand allows for *in situ* observation of the 3D nanostructural evolution during mechanical testing. Since gold is high absorbing for X-rays, NPG is also an optimal sample for evaluating the capability of an XTM setup.

A NPG sample was scanned with XTM at the P05 beamline at Petra III, to determine the inner structure of the sample. One major challenge in XTM is the overall stability of the setup, e.g. to minimize sample drifts and time-induced shifts from e.g. the motorized sample stages. In order to achieve the best possible data reconstruction even small shifts have to be corrected for. Therefore, projection images were first corrected for horizontal and vertical shifts [3], whereinafter the data was reconstructed with TomoPy, using an iterative reconstruction algorithm [4]. Morphological structure parameters such as Percentage Volume (VV), Structure thickness (St.Th), Specific Surface Area (SV) of NPG were evaluated using Pore3d [5] and compared to parameters obtained by FIB based tomography [2]. NPG is an optimal material for evaluating and improving the capabilities of the XTM setup at the P05 Beamline at PETRA III, which will also be presented more in detail.

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