

## Tungsten microspheres with controllable size produced by electrolysis and subsequent laser treatment.

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### Abstract

Tungsten microspheres are calibration and alignment devices developed by the Surface Science Laboratory at Synchrotron SOLEIL. They are currently used on SOLEIL's X-ray tomography beamline ANATOMIX and beamline PROXIMA-1. The tungsten microspheres are produced in a two-step process: First, an electro-chemical etching step is employed to obtain a sharp tungsten tip. Subsequently, a laser treatment melts the apex and a sphere ( $r_{\text{mean}} \in [10-40] \mu\text{m}$ ) is formed (Figure 1).

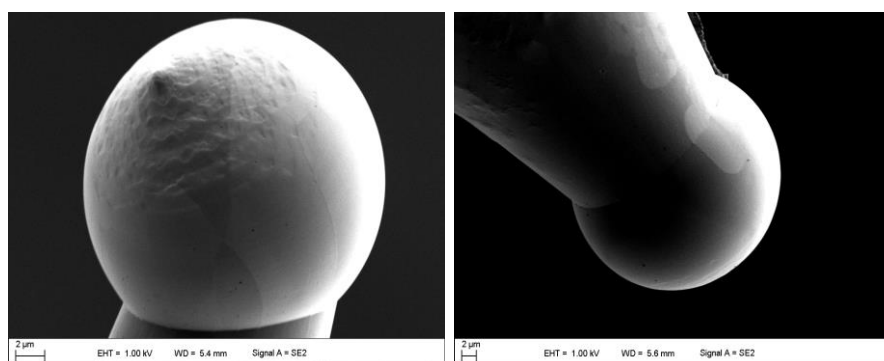
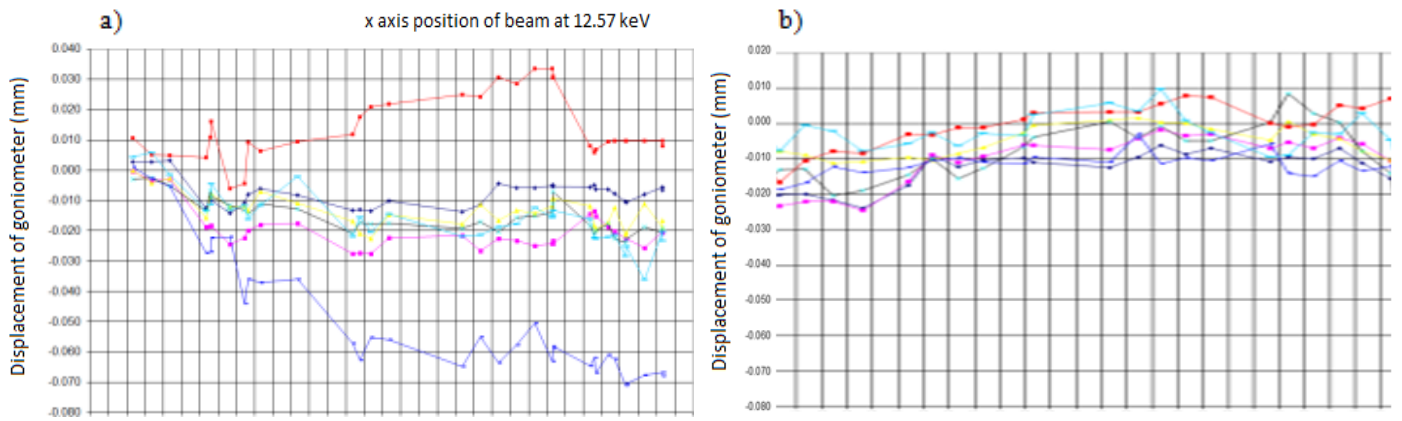


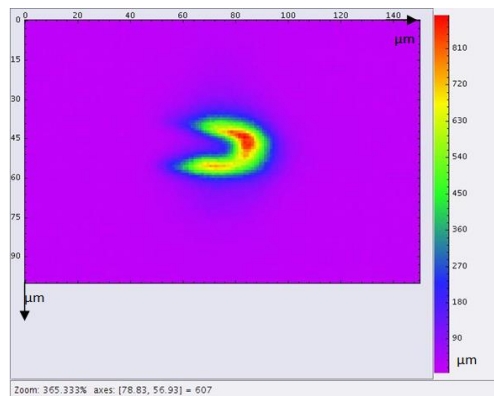
Figure 1: SEM image of tungsten microsphere (diameter: 28  $\mu\text{m}$ )

-PROXIMA-1:

The displacement of the goniometer at each alignment induces repeatability uncertainties in the acquisition of bio-crystallographic data. These movements become minimal thanks to the new alignment tool (Figure 2.1). A microsphere with a diameter between 20  $\mu\text{m}$  and 28  $\mu\text{m}$ , was employed to optimally shield the center of the x-ray beam (Figure 2.2).



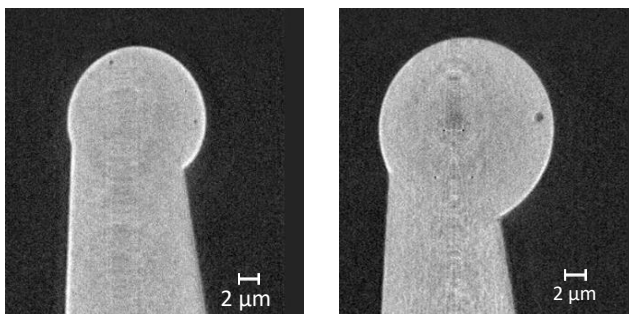
**Figure 2.1:** Follow-up of goniometer displacement:  
 a) Alignment with cruciform alignment tool.  
 b) Alignment with the tungsten microsphere.



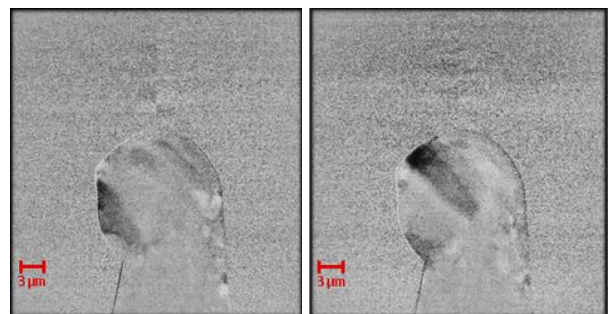
**Figure 2.2:** Shadow of Synchrotron Beam Zone by the microsphere

**-ANATOMIX:**

The X-ray tomography beamline ANATOMIX uses tungsten tips with a diameter between 10 and 12  $\mu\text{m}$  for alignment of the axis of rotation and quality control of its microtomography and nanotomography stations. Pores observed in tomography images of the microsphere (figure 2.3) allow the operators of the tomography instrument to determine the position of the axis of rotation, a parameter necessary for the reconstruction of the tomographic sections. Figure 2.4 shows contrast variations. They are interpreted as extinction occurring in crystallites illuminated under Bragg condition.



**Figure 2.3:** X-ray nanotomography of tungsten microsphere



**Figure 2.4:** X-ray nano-radiographs obtained on the ANATOMIX X-ray microscopy beamline.