



Designing an Exchangeable Biprism for In-Situ Electron Holography

Hyllested, Jes Ærøe; Yesibolati, Murat N.; Jensen, Flemming; Wagner, Jakob B.; Kasama, Takeshi

Publication date:
2018

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Hyllested, J. Æ., Yesibolati, M. N., Jensen, F., Wagner, J. B., & Kasama, T. (2018). *Designing an Exchangeable Biprism for In-Situ Electron Holography*. Poster session presented at 69th Annual Conference of the Nordic Microscopy Society, Kgs. Lyngby, Denmark.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Designing an Exchangeable Biprism for *In-Situ* Electron Holography

Jes Ærøe Hyllested*¹, Murat N. Yesibolati², Flemming Jensen¹,
Jakob B. Wagner¹ and Takeshi Kasama¹

¹DTU Cen/Danchip, Technical University of Denmark, Kgs. Lyngby, Denmark

²DTU Nanotech, Technical University of Denmark, Kgs. Lyngby, Denmark.

*E-mail: Jehy@dtu.dk

Keywords: Biprism, MEMS, Electron holography, Environmental TEM, Instrumentation

Off-axis electron holography is a TEM technique that allows for imaging magnetic and electric fields in materials quantitatively with nanometer spatial resolution. As such, it would be attractive to use electron holography in combination with environmental TEM (ETEM) with great potential for various applications: E.g., studies on changes in magnetic structures under reduction/oxidation conditions, charge distributions in catalytic nanoparticles under the presence of various gases, and electric field distributions in working fuel cells.

The conventional biprism is designed for high vacuum and 'clean' conditions in a TEM column. The pressure in ETEM conditions is higher by six orders of magnitude than that in a normal TEM and a significant number of gas molecules exist in the TEM column. Therefore, the conventional biprism device may not survive for a long period and may be contaminated by residue gas molecules. For these reasons, an easily exchangeable biprism device, with a high stability and resistance against corrosive gases would be required. Therefore, we have designed and fabricated an exchangeable biprism device using MEMS-based fabrication technology.

Figure 1 shows a schematic design of a MEMS-based biprism chip, where an Au/Si biprism wire with a vacuum space on both sides of the biprism wire will be fabricated. The optimal dimensions of the biprism wire and the vacuum space was calculated using COMSOL modelling software in order to generate uniform electric fields, where 'two' electron beams are deflected towards one another for making an interference overlap region. The biprism chip is mounted on a home-made biprism rod, which is inserted into the selected-area aperture port of a microscope column (Fig. 2). The rod also holds two spaces for mounting selected area apertures. This biprism device is made without a rotational functionality to achieve better mechanical stability, which would be desired for *in-situ* high-resolution electron holography of catalytic nanoparticles under ETEM conditions.

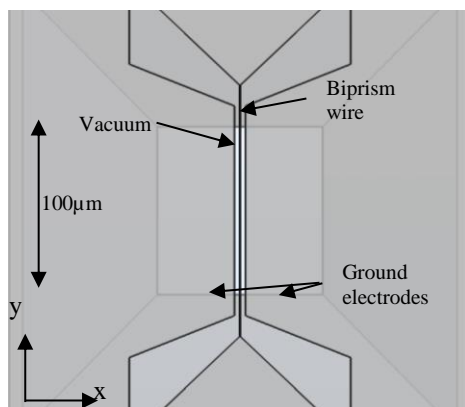


Figure 1: Design of the electron biprism chip.

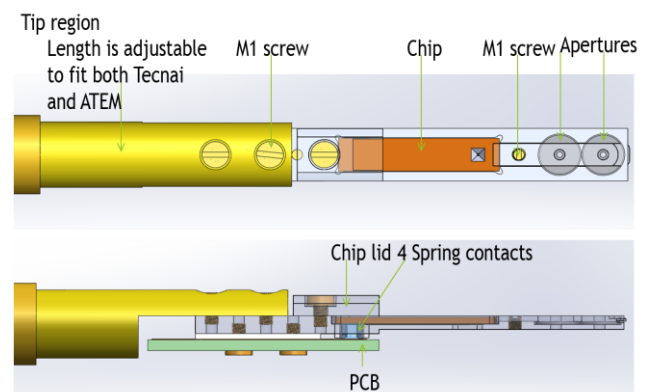


Figure 2: Schematic illustration of the electron biprism rod.