

# In-situ Lift-Out of TEM-Lamellae using a Compact and Precise Micromanipulator

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Angewandte F&E

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## Introduction

Lift-Out of TEM-Lamellae in most cases is done outside the FIB-System [1].

To investigate the advantages of recently introduced in-situ lift-out [2], we have integrated a compact and vacuum-compatible micromanipulator (Kleindiek Nanotechnik) into a LEO Gemini 1550 VP.

## Design of the Micromanipulator

3 Axes:  
2 Rotational Axes  
1 Linear Axes  
Based on Nanomotor  
Technology

No mechanical feedthrough necessary.  
Electrical isolated tip for probing.

## Setup for in-situ Manipulation

The manipulators are mounted on the upper wall of the specimen chamber. After manual coarse positioning of the needle in the field of view of the SEM or FIB, it is easy to reach the final position by the piezo motors. The position can be controlled by software or joysticks.



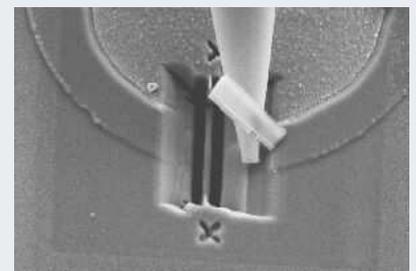
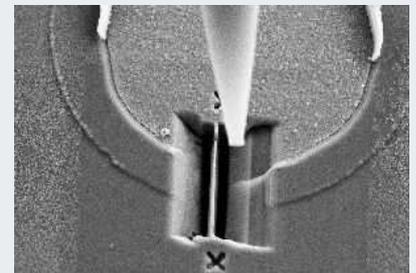
Two Micromanipulators mounted on the specimen stage.  
This kind of mounting is preferred, if the stage has to be tilted.

## Results

It is possible to position a small needle with nanometer accuracy under direct control of the FIB or SEM in the case of a Cross-Beam System.

To test the system, a TEM Lamella was milled at the border of an electrode of a BioChip.

By attaching a coated glass-needle with the manipulator, the lamellae could be removed from the chip and afterwards the lamella was moved in-situ to a TEM-Grid.



## Acknowledgement

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## References

- [1] L.R. Herlinger, S. Chevacharoenkul, D.C. Erwin  
TEM Sample Preparation Using a Focused Ion Beam and a Probe Manipulator in : Proc. 22nd International Symposium for Testing and Failure Analysis (ISTFA 96), (ASM International, Materials Park, Ohio) pp. 199-205 (1996).
- [2] B.W. Kempshall, S.M. Schwarz, L.A. Giannuzzi  
In-situ FIB lift-out for site specific TEM specimen preparation of grain boundaries and interfaces  
ICEM 15, Durban 2002

## Links

<http://www.nmi.de>

<http://www.leo.de>

<http://www.nanotechnik.com>

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