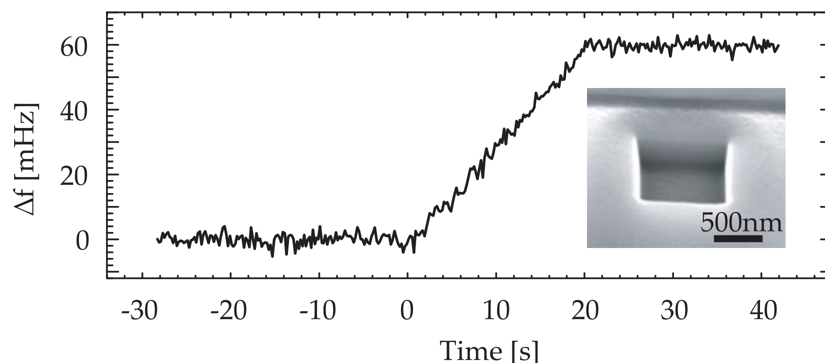
NANONIS APPLICATION NOTE

FEMTOGRAM RESOLUTION FOR in-situ MONITORING OF FIB AND E-BEAM INDUCED MILLING

The optimization of focused ion and electron beam induced processes for the reliable fabrication of micro- and nanodevices has been of increasing importance. For this a further understanding of the basic physics underlying the process is necessary. In-situ process monitoring is an efficient way to move forward in this field.

We used the Nanonis Oscillation Controller for tracking the change of the resonance frequency of a temperature stabilized piezoresistive cantilever, while material was deposited or removed by the focused ion and electron beams. The noise level for the frequency in the measurements is 1 mHz at f_{res}=43 kHz, corresponding to a minimum detectable mass of 10 fg. The limiting factor in the resolution of the mass detection is the resonator quality. Further reduction of the cantilever dimensions will significantly increase the sensitivity.

Thus, precise measurements of masses and even densities of new nano-sized material become possible and open the way for new mechanical applications of micro- and nanodevices.



Evolution of the cantilever resonance frequency during FIB sputtering of a 1x1µm^2 pit. Inset: SEM tilt view of the sputtered pit.

Authors:

V. Friedli, J. Michler, and I. Utke,
EMPA Thun, Switzerland

Nanonis Modules in Use:

- Base Package
- Oscillation Controller

System:

- Home-built AFM in SEM

Reference:

V. Friedli et al., Mass Sensor for in situ monitoring of focused ion and electron beam induced processes, Appl. Phys. Let. 90, 53106 (2007)

NANONIS
The SPM Application Experts

Nanonis GmbH, Zürich, Switzerland
www.nanonis.com