Application Note

"Shallow trench isolation" structures
Sample Preparation for TEM

related instrument Leica EM RES102
Cross-sectional preparation of structured semiconductor materials

"Shallow trench isolation" structures

PROBLEM
The cross-sectional preparation of structured semiconductor materials requires a very thorough mechanical pre-preparation. In doing this, it must be ensured that the structure of interest should be located as close to the centre of the sample as possible. As the sample will be ion milled from both sides, a specific preparation of the structure is necessary in most cases, which means that you must thin these structures from both sides. With three-dimensional repetitive structures (test structures), as mostly used in microelectronics, this is often no problem. If, however, you want to prepare individual structures with very small dimensions, the observation possibilities of conventional ion beam milling systems are insufficient for carrying out a target preparation. In that case one need a FIB system.

In the case of „Shallow trench isolation“ structures, the repetitive structures have already been brought to the centre of the cross-sectional sample by the mechanical pre-preparation.

PREPARATION CONDITIONS

Mechanical pre-preparation
The mechanical pre-preparation took place using the methods described in this chapter using a Ti grid. The individual steps are shown in Fig. 16.

Double sided polishing of the sample was carried out with the TXP:
Diamond foils: 15 µm, 9 µm, 6 µm, 3 µm, 1 µm and 0.5 µm at 2200 rpm until the final sample thickness of 30 µm.

Ion milling
Sample holder: Quick-clamp-holder
Acceleration voltage: 7 kV / 2kV (final thinning)
Milling angle: 5° (milling on both sides)
Sample movement: Oscillation (45°)

RESULTS
The structures of interest lie within the radiated area of the sample. The structures were very evenly thinned, so that even high resolution TEM examination of the interfaces were possible.
TEM cross-sectional images of a „Shallow trench isolation” structure (Si / SiO2 / SiN4)
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