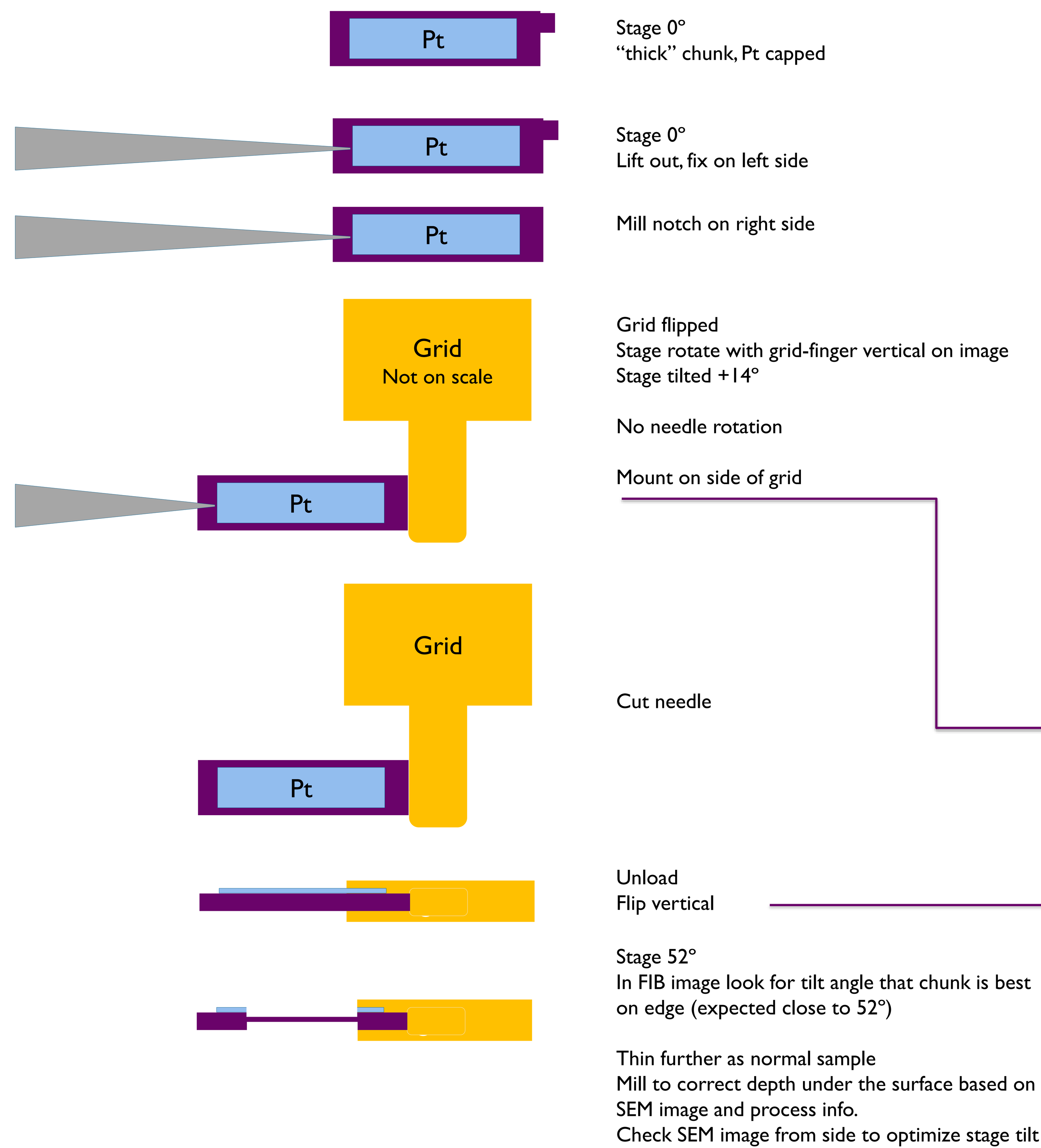
Plan-view TEM specimen preparation of device structures with FIB

Patricia Van Marcke, Hugo Bender, Olivier Richard, Paola Favia
Imec, Leuven, Belgium

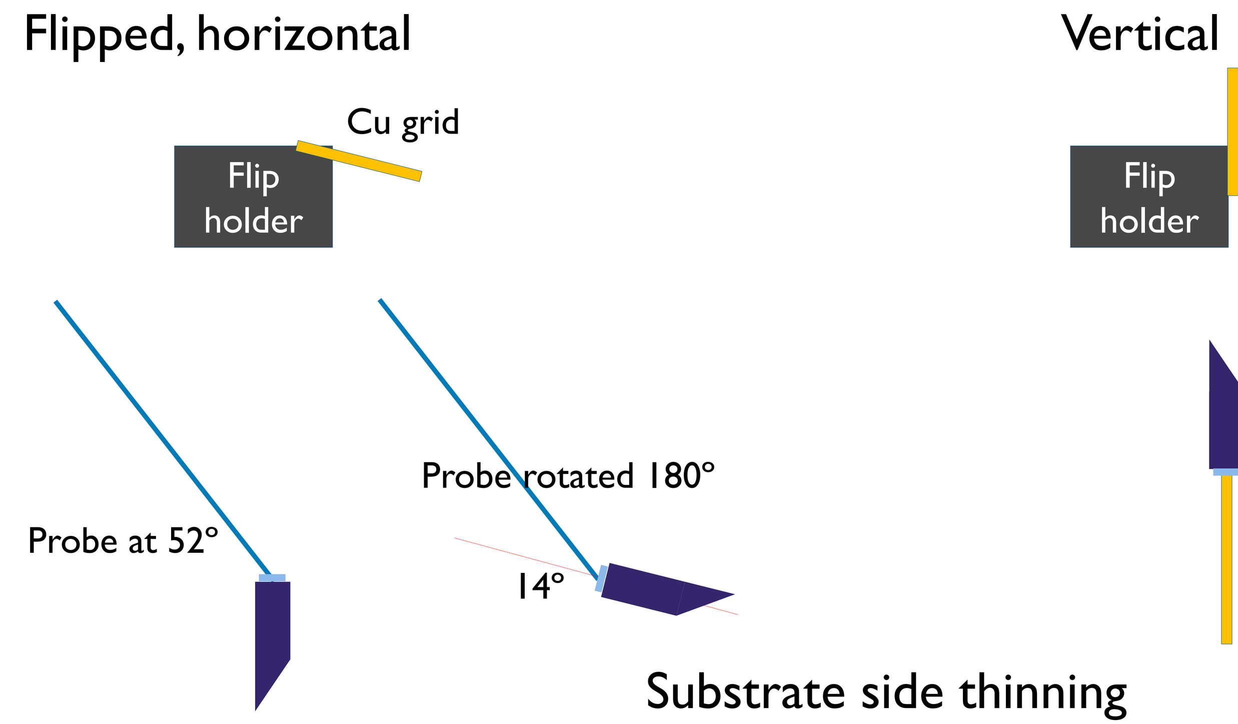
Summary

Most TEM studies of semiconductor device structures are performed in cross-section using specimens prepared by Focused ion beam with in-situ or ex-situ lift-out procedures. To reduce curtaining artefacts and to obtain thinner specimens, substrate side thinning (SST) has gained importance recently. For this purpose special sample holder is used and 180° rotation of the probe after lift-out of the lamellae is done.
Plan-view specimen preparation with FIB also allows side-specific analysis and procedures for the preparation have been proposed before. In this work we discuss a methodology for plan-view specimen preparation using the SST sample holder. The different steps involved are discussed and illustrated with some TEM results.

Procedure



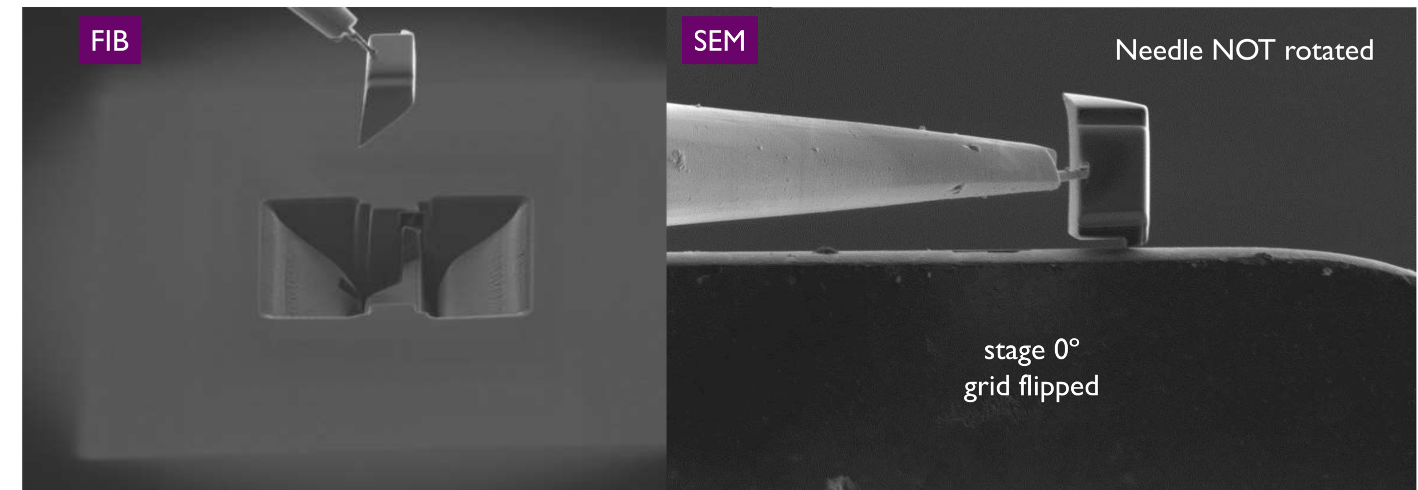
Flip holder configuration for substrate side thinning



Plan view preparation with flip holder

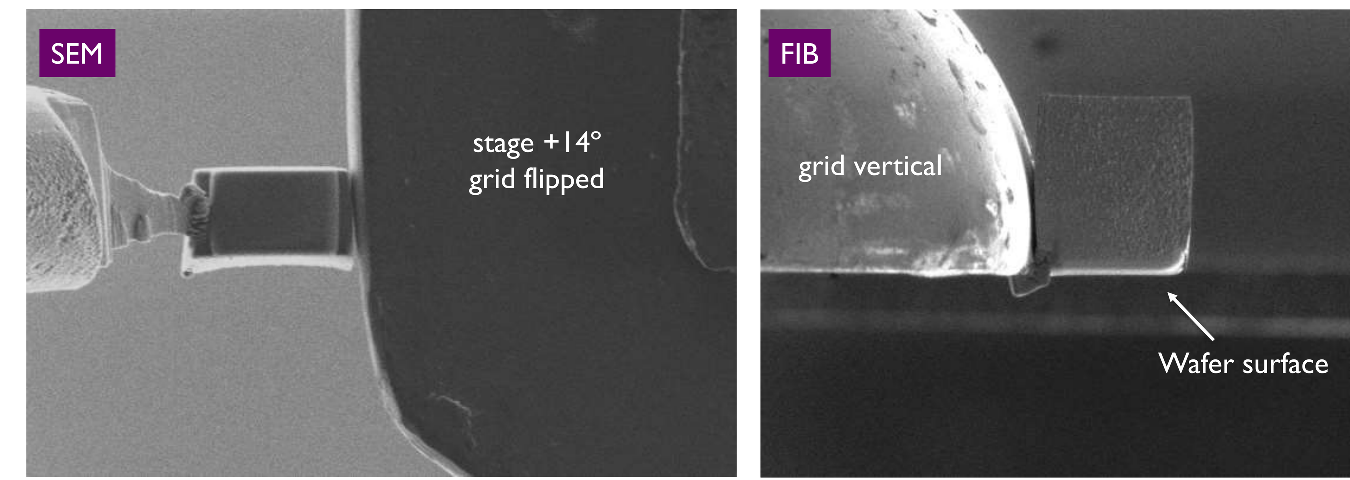
As SST but no needle rotation

Bad procedure as this requires 52 ± 14° tilt for final thinning (which is out of range ...)



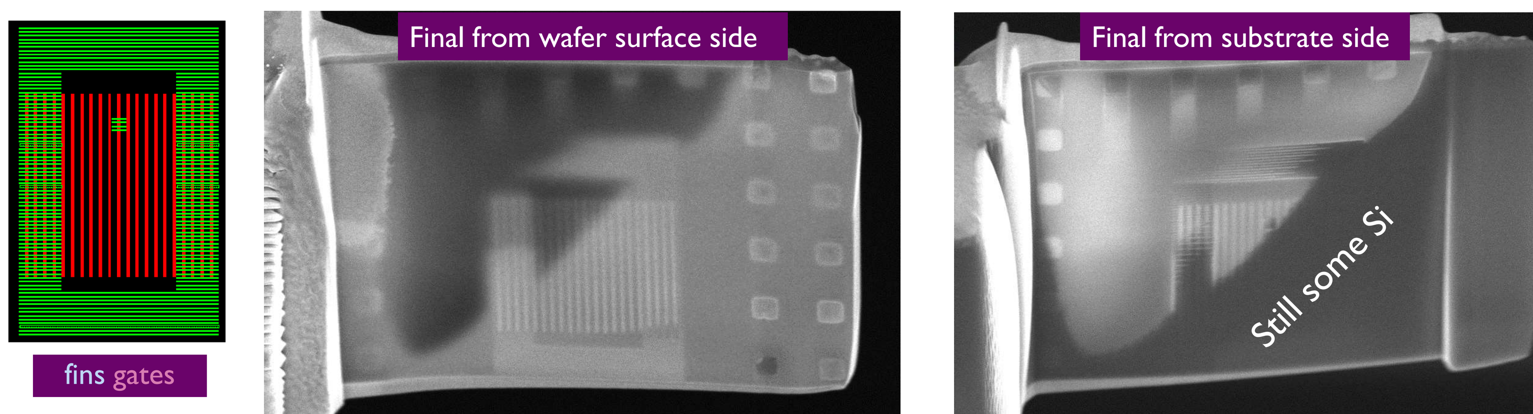
Good procedure

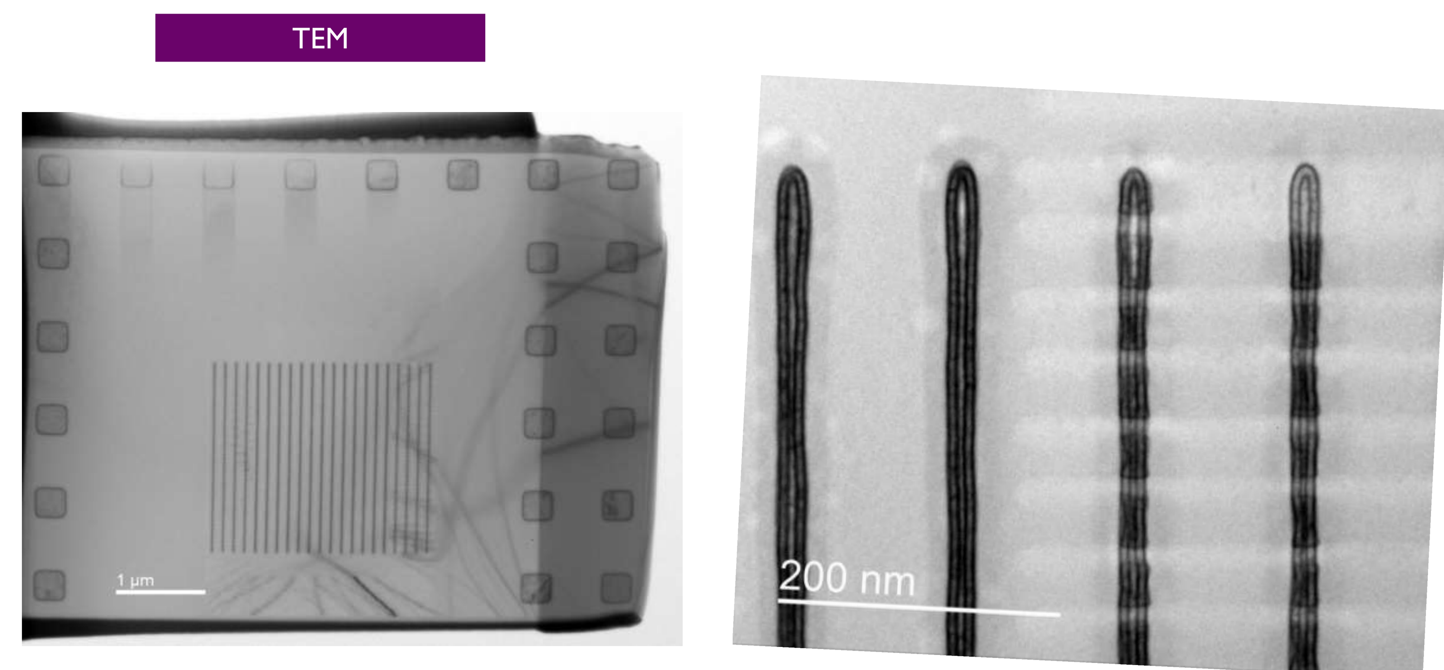
Stage rotated and tilted +14°



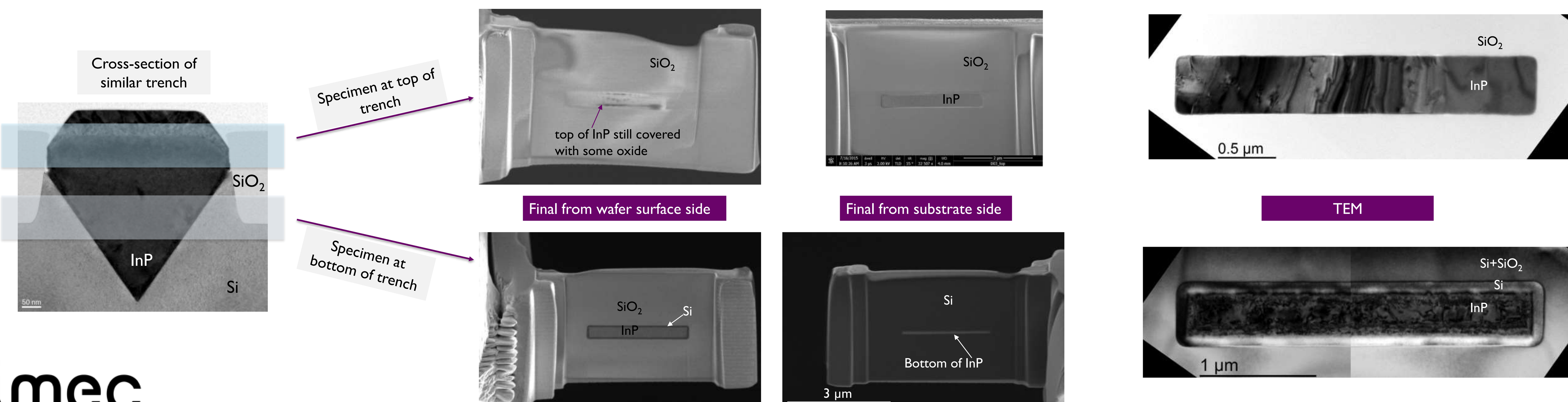
Applications

Replacement metal gate lines on finfet device





InP trench, bottom and top defect distribution



imec