Collaborative project*

Project acronym: SNM

Project full title: "**Single Nanometer Manufacturing for beyond CMOS devices**"

Grant agreement no: 318804

Deliverable: 7.1 ("E-beam transparent Si_3N_4 supports")

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List of participants:

Participant no.	Participant organisation name	Part. short name	Activity Type	Country
1 (Co)	Technische Universität Ilmenau	**TUIL**	HER	Germany
2	EV Group E. Thallner GmbH	**EVG**	IND; End-user	Austria
3	IMEC	**IMEC**	RES	Belgium
4	Mikrosistemi Ltd	**µS**	SME; End-User	Bulgaria
5	Universität Bayreuth	**UBT**	HER	Germany
6	Technische Universiteit Delft	**TUD**	HER	Netherlands
7	Spanish National Research Council	**CSIC**	RES	Spain
8	IBM Research GmbH	**IBM**	IND; End-user	Switzerland
9	École polytechnique fédérale de Lausanne	**EPFL**	HER	Switzerland
10	SwissLitho AG	**SL**	SME; End-User	Switzerland
11	Oxford Instruments Nanotechnology Tools Ltd	**OINT**	IND; End-user	UK
12	Imperial College London	**IMPERIAL**	HER	UK
13	The Open University	**OU**	HER	UK
14	Oxford Scientific Consultants Ltd	**OSC**	SME	UK
15	VSL Dutch Metrology Institute	**VSL**	IND	Netherlands
16	University of Liverpool	**ULIV**	HER	UK

SNM

Work Package 3

Deliverable: 3.1 ("E-beam transparent Si_3N_4 supports")

Lead beneficiary number	9	**Nature**	R	**Dissemination level**	PU
Estimated Person-months	12.00				
Person-months by partner for the Deliverable	EPFL: 11.5				
Estimated Delivery Date	Month 12	**Delivery Date** December 19th, 2013		Month 12	

Description of the Deliverable

E-beam transparent Si3N4 supports The goal of this deliverable was to develop a process flow for the fabrication of electron-beam transparent silicon-nitride TEM samples for state-of the art TEM imaging and CD determination with subnanometer resolution of patterns produced in the SNM project. This technological platform will be especially useful for line width and line edge roughness determination in patterned resist layers and transferred patterns and can also be used as a back-up metrology tool during the development of high-resolution AFM –based metrological tools.

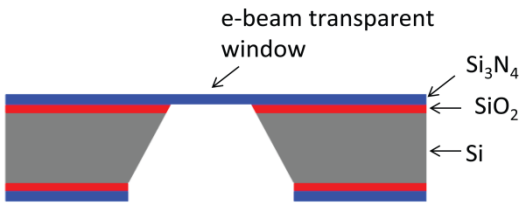
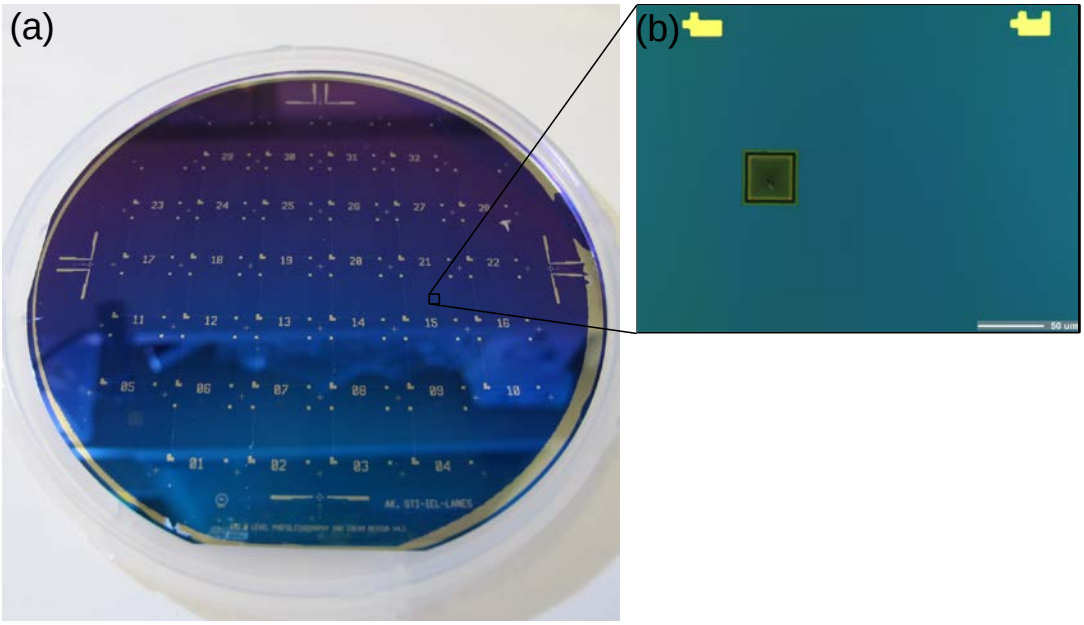


Figure 1. Schematic cross-section of an e-beam transparent Si_3N_4 membrane.

Figure 1 shows the cross-section of the membrane. They are fabricated using conventional photolithography combined with wet and dry etching. Si_3N_4 and SiO_2 are first deposited on commercial Si wafers. Alignment and fiducial markers are fabricated on the top side. Square windows are opened on the bottom site using dry etching. The back side is further etched using KOH at 80 °C, resulting in 50 µm × 50 µM windows in 20 nm thick Si_3N_4. This membrane thickness presents a compromise between the need to have mechanical stable membranes with are in the same time sufficiently thin to be electron beam transparent. The

	membranes can further be coated with CVD graphene in order to provide an atomically thin and conductive bottom layer which may be needed for certain SNM lithographic methods.  **Figure 2 (a) Photograph of a 4" wafer containing 64 TEM compatible membranes. (b) A closeup view of a membrane.** Figure 2 shows the front side of a wafer containing 64 TEM-transparent membranes, each with a dimension of 50µm × 50 µm (b).
Explanation of the Differences between Estimation and Realisation	D7.1 has been achieved in its totality.