

Semiconductor Equipment Assessment Leveraging Innovation

SEAL is an integrated project consisting of 17 equipment assessment sub-projects and supportive cross-cut R&D in the area of semiconductor manufacturing. The assessment themes are spread amongst processing and metrology equipment, leveraging innovation both for More Moore and More-than-Moore applications.

At a Glance: SEAL

Semiconductor Equipment Assessment Leveraging Innovation



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Partners:

Fraunhofer (DE), semilab (HU), MEMC Electronic Materials (IT), COMMISSARIAT A L' ENERGIE ATOMIQUE,CEA-LETI (FR), imec (BE), PVA TePla (DE), Siltronic (DE), Fries Research and Technology (DE), Oxford Instruments (DE), Infineon Technologies (DE), HamaTech APE (DE), Intel Corporation (US), STMICROELECTRONICS CROLLES 2 (FR), Nanda Technologies (DE), Applied Materials (IL), Integrated Circuit Testing (DE), Metryx (UK), GLOBALFOUNDRIES (DE), ION BEAM SERVICES (FR), Jenoptik Automatisierungstechnik (DE), NUMONYX ITALY (IT), KLA-Tencor Israel (IL), College of Nanoscale Science and Engineering, UALB (US), Reinhardt Microtech, RMT (CH), SUSS MicroTec Lithography, SMTL (DE), MAPPER LITHOGRAPHY (NL), TOPPAN Photomasks (FR), ProTec Carrier Systems (DE), HQ-Dielectrics (DE), SUSS MicroOptics, SMO (CH), Alcatel Vacuum Technology France, AVTF (FR), Landshut Silicon Foundry, LFoundry (DE), Fachhochschule Wiener Neustadt, FHWN (AT), Catalan Institute of Nanotechnology, ICN (ES)

Duration: June 2010 – May 2013

Funding scheme: IP

Total Cost: € 14.3m

EC Contribution: € 9.1m

Contract Number: INFSO-ICT-257379

Main Objectives

The **strategic objective of SEAL** is to effectively combine efforts, resources and expertise in a **joint assessment of novel equipment for semiconductor manufacturing**, and supporting it by **innovative cross-cut R&D** dedicated to the identified needs of the assessment sub-projects: The work programme for each of the 17 equipment sub-projects deals with the **assessment of innovative prototype equipment and materials** for manufacturing processes beyond the current state-of-the-art. Each of these sub-projects is user driven. The main goal is to **establish that European equipment** can satisfy the demands for the progressively emerging technology requirements in a consistent, timely and cost effective manner.

Technical Approach

For each equipment assessment, an effective “triangle” of an equipment supplier, a supportive R&D institute and a potential end user was built. By this means, advanced R&D topics are combined with assessment of equipment or novel enhancements to existing equipment, and their application to next generation semiconductor technologies and device architectures. SEAL involves a wide community of equipment suppliers, material manufacturers - including SMEs - semiconductor manufactures and research institutes.

Key Issues and Expected Impact

- **Strengthening the European process and metrology equipment industry**
- Bring together **critical mass** of research and development power to **form synergies**
- Make **use of the excellent European 300mm research infrastructure** at Fraunhofer IISB, CEA/LETI and imec
- Increase **chances for SME's** to get access to IC makers
- Stimulate an approach to **initiate sustaining partnerships** amongst equipment industry, IC industry and research institutions
- Developing a **common strategy** for key enabling technologies in the EU
- Stabilize and increase the participation of European equipment industry in EU FP VII, ENIAC, CATRENE and national programmes etc.

Overview on sub-projects, topics and partners in SEAL

Sub-project number, Title, and Acronym	Partner	Short description
SP1 - Sustainable R&D activities (R&D)	Fraunhofer IISB , CEA-LETI, imec, ICN, FH-WN	<ul style="list-style-type: none"> Identification of common problems and challenges amongst the SEAL sub-projects Implementation of cross-cut R&D activities aiming at overall and sustainable solutions
SP2 - HamaTech EUV Mask Track Pro (EUVMTTP)	HamaTech APE , imec, Intel	<ul style="list-style-type: none"> Implementation of cleaning technique for EUV masks Software and hardware assessment for high volume EUV production
SP3 - Advanced Vacuum wafer Drying for A-TLS Dicing (A2D2)	AVTF , Fraunhofer IISB, Jenoptik, UALB	<ul style="list-style-type: none"> Evaluation of diced wafers cleaning method Integration and assessment of cleaning module in A-TLS tool
SP4 - Flexible Illumination System for Mask Aligners (FISMA)	SMO , Fraunhofer IISB, RMT, SMTL	<ul style="list-style-type: none"> Implementation of new illumination optics for mask aligners Assessment by simulations and experiments
SP5 - MAssively PArallel electron beam lithography (MAPA)	MAPPER , CEA-LETI, STM CROLLES, TOP-PAN	<ul style="list-style-type: none"> Parallel e-beam lithography for 32nm (22nm logic) node Integration into mask maker Assessment of infrastructure (process, data flow, and proximity effect correction)
SP6 - Electron Enhanced Low Temperature Oxidation for Nano-Electronic Device Generations (E2O)	HQ-Dielectrics , Fraunhofer IISB, Infineon	<ul style="list-style-type: none"> Evaluation of low-temperature oxidation technology Integration of reactor into cluster platform and assessment of oxide quality
SP7 - New solutions for 300mm temporary carrier bonding (TCB300)	SMTL , imec, STM CROLLES	<ul style="list-style-type: none"> Handling of extremely thinned Silicon device wafers Processes and equipment assessment
SP8 - Plasma Immersion Ion Implantation Tool for Defect Engineering and CMOS imager application (Plasma-Trans)	ION BEAM SERVICES , CEA-LETI, STM CROLLES	<ul style="list-style-type: none"> Extension of application field by tool modification (process control, pressure, temperature) Assessment of modified tool
SP9 - Cleaning of Sensitive Interconnect Structures (C-SIS)	Not yet defined, Fraunhofer IISB	<ul style="list-style-type: none"> Validation of wet chemical cleans for $\leq 22/28$ nm node Installation, qualification and beta testing of new cleaning modules
SP10 - Innovative Meso Defect Inspection (IMDI)	Nanda , STM CROLLES, imec, Fraunhofer IISB	<ul style="list-style-type: none"> Implementation of new very high throughput and high sensitivity approach for wafer inspection. Assessment for 3D-Integration (TSV), patterned and un-patterned wafer inspection
SP11 - Near Field microwave photo-conductive decay for lifetime measurement (NFmicroPCD)	Semilab , MEMC, Fraunhofer IISB	<ul style="list-style-type: none"> Integration of near field and photo-decay measurement methods Assessment of lifetime-measurements with 25μm lateral resolution on product wafers
SP12 - White-light interferometer system for the development of 300 mm wafer mechanical processes on the nanometer scale (WISDoMP)	Fries Research & Technology , Siltronic, Fraunhofer IISB	<ul style="list-style-type: none"> Application of white-light interferometry to assess the full surface topography of Silicon wafers Development and assessment of nanotopography concepts
SP13 - High Resolution Multi Column E-Beam Wafer Inspection – Prototype Assessment at Wafer Fab Production Floor (MCEB)	AMIL , GLOBALFOUNDRIES, Integrated Circuit Testing	<ul style="list-style-type: none"> Assessment of E-Beam inspection technology meeting resolution and throughput requirements of 22nm node Tool improvements based on fab feedback
SP14 - Nanometre range element analysis with a large angular EDS detector (NaREA)	Oxford Instruments , Fraunhofer IISB, Infineon	<ul style="list-style-type: none"> Assessment of a superior detector for high resolution x-ray analysis Qualification of very fast film thickness and chemical composition measurements
SP15 - More Mass Metrology for Monitoring (M4)	Metryx , Intel, imec	<ul style="list-style-type: none"> Assessment of fab ready 300mm tool for mass metrology Evaluation of new applications like Ion Implantation, Gate Stack, barrier seed layers for BEoL and 3D integration
SP16 - Wafer level Automatic Acoustic Very high resolution characterization (WAAVE)	PVA Tepla , STM CROLLES, CEA-LETI	<ul style="list-style-type: none"> Assessment of acoustic characterization tool Development of new methods for analysis of buried layer and substrate parameters
SP17 - Combined image-based and diffraction-based overlay metrology for the 22nm technology node and beyond (COMBO)	KLA-Tencor , imec, NUMONYX	<ul style="list-style-type: none"> Platform assessment for overlay measurements to meet 22nm nodes requirements. Performance evaluation for image and diffraction based techniques
SP18 - Handling and Processing of Ultra-/Thin Wafers by Electro Static Carrier Technology (HPW-ESC)	ProTec , LFoundry, Fraunhofer IISB	<ul style="list-style-type: none"> Assessment of electrostatic carrier technology for handling ultra-/thin wafers Carrier optimization to meet wafer processing requirements
SP19 - Integrated Project Management (Management)	Fraunhofer IISB	<ul style="list-style-type: none"> Management of the Integrated Project covering Project Management and Sub-Project Management