EEMI450 and global 450mm Cooperation

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- Semi Consulting on behalf of ASM
Overview

- EEMI450
- International Collaboration
- Enable450

Bridge450 Workshop
**European Equipment & Materials Initiative for 450mm**

**Membership**

- **Started in 2009**
  - 20 members

- **2010 (start 1st project)**
  - 32 members

- **2011**
  - 40

- **2012**
  - 46

- **2013**
  - 56 members
EEMI450 related projects

Bridge450 Workshop

NGC45

SO450

EEM450

EE MI

Enable450 CA

SEAM4

E450P

KET
The EEMI450 community has initiated 9 European 450mm projects, which were granted up to now:

- EEMI450 (ENIAC) 2010 - 2012
- NGC450 (Catene), started end of 2011 till end off 2014
- SOI450 (Catene), started end of 2011 till 2014
- EEM450PR (ENIAC), started in April 2012 till April 2015
- Enable450 (FP7 CA), started end of 2012 till end of 2015
- E450EDL (ENIAC KET- Demo line), started Q3/13, for 3 yrs.
- SEA4KET (FP7, partly 450mm) started Q4/13, duration 3 years
- Bridge450 (FP7 CSA), has started Q4/2013, duration 2 years
- E450LMDAP (ENIAC) will start in Q4/2014
All current ENIAC and Catrène projects are containing equipment evaluations at imec, especially E450EDL (Equipment-demo-line) and E450LMDAP, which are targeting a European 450mm demo/pilot line at imec.

The project NGC450 took the lead to include the 1\textsuperscript{st} 450mm system evaluation at imec.
METRO450

Members:
- AMIL
- Jordan Valley
- Nova
- Intel
- Nanomotion
- Mellanox (Observer)
- CI-Semi (Observer)
- Technion, TAU, University of Haifa, BGU

Leverage the worldwide 450mm inflection point by utilizing the strengths of the Israeli metrology industry and academia to increase Israeli market share of Metro tools.
Objective

- Develop and demonstrate the generic technologies needed for the best 450mm metrology platform

<table>
<thead>
<tr>
<th></th>
<th>300mm</th>
<th>450mm</th>
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<tbody>
<tr>
<td>Dies out</td>
<td>X 1.0</td>
<td>X 2.5</td>
</tr>
<tr>
<td>Stage accuracy</td>
<td>1.0 u</td>
<td>0.1 u</td>
</tr>
<tr>
<td>Data Processing</td>
<td>1GB/S</td>
<td>100GB/s</td>
</tr>
<tr>
<td>Backside Contamination</td>
<td>1 PWP /500nm</td>
<td>1 PWP/50nm</td>
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<tr>
<td>Reaction response time</td>
<td>12 hours</td>
<td>1 hour</td>
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Overview

- EEMI450
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- Enable450
Within the Enable450 project, a so-called Coordination Action funded by the EU, international collaboration was one of the tasks defined.

During the first year of the project several discussions with G450C, both face-to-face (Brussels and Albany), as by conf. calls, took place to exchange information and establish common cooperation topics.

In addition on the Taiwan-EU ICT Technical Cooperation Conference in March 2013, several 450mm presentations were given by EEMI450 members.
Next to this project a second similar project was granted, Bridge450, the organizer of today’s workshop, with additional focus on Asia.
EEMI450-G450C topics of cooperation

- Common protocol for tool assessment and alignment on DTS (Demonstration Test Method)
  - Advantage for equipment suppliers: Tools can be evaluated at either imec or G450C and results are transparent
  - Opens coordination between imec and G450C, where equipment is to be assessed
  - Currently 2 active equipment evaluations will be directed under the common DTS, one at imec, one at G450C
EEMI450-G450C topics of cooperation

- Metrology
  - Overview what is available on both sides of the ocean was shared.
  - Especially in the early phase where not all equipment is available everywhere a “global” lab would be advantageous
  - Cooperation between G450C and Metro450 under discussion
  - Standard calibration wafer on the agenda
• **Driver**
  - Need a standard ‘gauge’ for metro tool qualification and tool-to-tool matching

• **Technology Gaps**
  - No standard qualification methodology for metro tools is available
  - Qualification time at vendor and matching time at the user are too long

• **Advances sofar**
  - Evaluated different tool calibration procedures; Defined tool accuracy & tool-to-tool matching criteria
  - Agreed upon a set of generic calibration targets for Metro platform calibration
EEMI450-G450C topics of cooperation

- 450mm (test) wafers
  - European partners, coordinated by imec, are sending their requirements concerning
    - Quality, numbers and timing
to G450C, which will include those in their total 450mm wafer orders

- Advantages
  - Pricing
  - Consistent quality both sides of the ocean.
AMC

Influence of FOUPs on wafer contamination level resulting from:

- Inefficient cleaning/drying procedures
- Outgasing from FOUP material
- Outgasing from processed wafers (e.g. acids) → absorption and chemiesorption in FOUP material
- Wafer cross contamination
- External contamination (cleanroom)

Control of optimization solutions:

- FOUP purge to reduce cross contamination and species adsorption on wafer surface
- Breather filters to reduce external contamination
- Advanced FOUP cleaning and drying procedures
- Improved detection of contaminants (e.g. utilizing AMC sensors)
- Optimization of FOUP materials
EEMI450-G450C topics of cooperation

- Flying wafer for 450mm

**Objective**
To develop a gradual concept for the implementation of a flying wafer infrastructure for 450 mm, building on the process resources at 450 mm sites, R&D sites, equipment suppliers to accelerate collaboration and learning curve.

**Proposed activities**
Exhaustive specifications of a flying wafer infrastructure with different grades of implementation levels, e.g., base level (e.g., for equipment supplier) with wafer specifications. High end level (manufacturing site) includes full set of specifications.

A kind of “Flying Wafer™” certificate might be elaborated; Fraunhofer IISB might act as certification entity providing the required expertise and control methods and services, respectively.
EEMI450-G450C topics of cooperation

- **Flying wafer (concept 300mm)**
  - Wafers are exchanged between R&D sites for processing and characterisation
  - Wafers are transferred using predefined I/O procedures
  - Wafer controlled using defined specifications for contamination level and control methods
  - Process/metrology and logistic data is transferred to and made accessible by a Central Planning and Control System (CPCS)

Source: FhG IISB

Bridge450 Workshop
EEMI450-G450C topics of cooperation

- Flying wafer wafer transport carrier
EEMI450-G450C topics of cooperation

- 450mm Pocket wafer (Xycarb)
  - A common 450mm pocket wafer
  - To be able to measure smaller wafers in a 450mm environment is under discussion as well

- Green idle mode
  - Green idle mode of vacuum equipment, under development in the EEM450PR project, (also in ENIAC Silver) is on the common agenda as well. Standards are being developed, but process implications have to be investigated.
The Facilities 450mm Consortium (F450C) is a first-of-its-kind partnership at SUNY’s College of Nanoscale Science and Engineering (CNSE) that is leading the global effort to design and build next-generation 450mm computer chip fabrication facilities. The collaboration includes 10 of the world’s leading nano-electronics facility companies, including Air Liquide, CH2M HILL, CS Clean Systems, Ceres Technologies, Edwards, Haws Corporation, Mega Fluid Systems, M&W Group, Ovivo and Swagelock.

One of the objectives is to come to standard facilities 3D template for installation to ease the effort and reduce installation time when the system is brought into the cleanroom.
EEMI450-G450C topics of cooperation

3D template

OHT
Loadport / EFEM
Central Handler / Process modules
Facilities Adaptor Plate (example)
CART
RMF
Waffle slab
Sub-fab
Attachments to concrete floor, adaptor plate and tool mainframe for lateral stability

Bridge450 Workshop
EEMI450-G450C topics of cooperation

- SEA4KET (FP7) project
  - In this European project a vertical furnace will be evaluated at G450C
  - Data obtained at G450C may be used in the project
Overview

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Within the Enable450 project a bi-monthly Newsletter is generated, distributed and published on the project website: www.enable450.eu

This newsletter provided by Future Horizons gathers global 450mm related information and is available to the global community.
Within Enable450 a database will be created that will encompass 450mm requirements on process, equipment and materials.

This database will be made accessible to EEMI450 members
Therefore!

- Become a member of EEMI450!
- Free of charge
- Bi-annual meetings to get updated on EU and international progress
- Be part of the EU 450mm efforts and link to all the 450mm related projects
- Have access to the members only part of the website: www.eemi450.net
EEMI450 member requirement

- Only requirement to become a member is that your entity has R&D and/or manufacturing activities in the EU or in one of the associated member states.
- Thus just a sales/service office won’t be eligible.
- Actually the same requirement to be able to join a FP7/H2020 project.
Membership

If interested contact:

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Thank you for your attention!