

Annex I. Follow-ups to Reviewers' recommendations (First Year Review Meeting, Brussels, February 23rd, 2005).

EUROSIO July 2005

Internal Report

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Website

The electronic communication must be improved substantially, primarily by utilization of the web site. Up to date there are no discussions on the electronic forum. The network members should use this website to announce their courses, working groups, job opportunities, etc. This is also important for interested parties outside of the consortium. Further, more action should be undertaken to interact with SINANO and NANOCMOS.

The EUROSIO website (www.eurosoi.org), which was supposed to become a “virtual research centre”, is at present basically only an empty framework. The website needs significant collaborations coming from all the EUROSIO members. Members should submit information to publish in the Website:

- News
- Resources
- Project results
- Reports
- Links of interest
- On-line seminars
- Advertising of training courses
- Job opportunities
- Funding opportunities
- Conference proceedings

SoA report

For the next months it is recommended to:

- Complete the missing chapters. Try to give the state-of-the-art in more quantitative form, e.g., values of mobilities, thicknesses, gate lengths.
- Use illustrations, add a list of abbreviations.
- Use uniform styles. Some sections describe in-house techniques, while others describe the situation worldwide.

- Add a more direct brief comparison of the status with the existing industry roadmap ITRS.
- Remove repetitions and instead make cross-references within report (e.g. on Ge condensation technique). For instance: Remove 2.6, which is included two times.
- Many chapters (ch. 2) list only strengths, no weaknesses.
- Some parts are very short, e.g. on 2.12 multiple gate transistors, etc.
- Parts of Ch. 6 and 7 missing and overall very brief.

Roadmap

- Some parts are pretty well written (especially chapter 1 prepared by SOITEC). However, other parts are still preliminary and/or too brief (e.g. characterization (2), reliability (6)).
- In some parts, conclusions or recommendations are missing. A clear list of conclusions and recommendations is given about materials research (chapter 1). The same is expected in all the chapters. Therefore, please try to follow the same style as Chapter 1
- The part on modelling is elaborated quite well.
- The area beyond CMOS has not been addressed yet.
- Try to indicate the needs of the industry.
- Produce an overview of short term, medium term, and long term development needs. Define the time line (at least) or, rather, a matrix (long term vs. short term; big impact vs. small impact).
- Provide a direct brief comparison with the existing industry roadmap ITRS (in which way is this roadmap different).
- A big portion of the roadmap seems to be elaborated mainly at the Coordinator's institute. It is mandatory the cooperation of experts from different areas to improve the final result.

“Who is Who” guide

- It is important to include new members and reference to industries worldwide.
- It is recommended to produce a matrix of competences and facilities: where are the overlaps, where can joint strength be obtained (by avoiding scattered efforts)? Where can some level of integration be achieved?

Continuation of the Network

- The consortium should develop plans for further continuation beyond the end of the project. One possible mode is by submitting research projects within IST. It is recommended to also bring in the research themes from the roadmap in SINANO and NANOCMOS.
- In the second year, there should be more exchange visits than in the first year (to be in conformity with the plan).

Conclusions

- The deliverables of the research Roadmap and the SoA will be an important outcome of the project. If they summarize the viewpoint of all 29 partners, it will be a step forward toward integration of research efforts. These documents still need major structuring and filtering. If the reports are written in an

accessible way and if it contains clear, crisp conclusions and recommendations in each subfield it will be the most important measurable outcome of the project.

- The web pages need a major upgrade. Information to be included: Job opportunities, “who is who” guide, public reports whatsoever, links to related useful websites, announcements of courses, working group information, references to workshops, meetings, etc. Summarizing, there are few public information.
- The MB has to decide how to continue the work developed by the Network. It is important to make a decision as soon as possible since there are only 6 months till the end of Network.

Recommendations

Recommendation 1: About the Roadmap and the SoA reports, please read below the recommendations addressed for each one of the chapters.

Recommendation 2: The website needs to be extended substantially. There should be more effort to make deliverables publicly available, in order to have impact beyond the boundaries of the consortium. It would be good if the website does not only contain a list of papers, but also (as far as possible) the text of the papers itself. Could it be possible to ask for internal reports and preprints?

Recommendation 3: There is feed back available on training activities. An apparent need among students to have real courses, not just extended conference contributions. Follow up with pedagogic training (tutorials, introductory) and provide handouts before the training event.

Recommendation 4: Try to encourage people (especially PhD students) to visit other members to facilitate the collaboration. Have short reports of *each* technical visit.

Recommendation 5: Make links with SINANO/NANOCMOS. Look also at activities of the European Nanoelectronics Initiative Advisory Council (ENIAC), who are making a strategic research agenda.

Recommendation 6: One possible mode to continue the network is by submitting research projects within IST. Consider the different possibilities available in the next 7th Framework Programme on Research, Technological Development and Demonstration

SoA and Roadmap reports

Each chapter is coordinated for a member (see table below) that will appear as responsible for the final report presented at the EU Commission and that will be available to the whole SOI community.

Person-months: 10; Total Cost: 54400 €

Concept	Total in €
Personal Costs (UGR) : 1 Person-months x 4000€	4000
Personal Costs (INPG) : 1 Person-months x 5000€	5000
Personal Costs (UCL) : 1,5 Person-months x 5000€	7500
Personal Costs (SOITEC) : 1,5 Person-months x 5000€	7500
Personal Costs (VTT) : 1,5 Person-months x 5000€	7500
Personal Costs (CISSOID) : 1,5 Person-months x 5000€	7500
Personal Costs (IMEC) : 0,5 Person-months x 12000€	6000
Personal Costs (PHILIPS) : 1,5 Person-months x 5000€	7500
Report (Editing)	1900
TOTAL	54400

Up to now we have prepared a preliminary version of the SoA, Roadmap and “Who is who”. However, it is necessary to prepare the final version of these documents. In order to achieve this goal, please follow the recommendations you will find for each one of the chapters. Moreover, you are free to add any other comment or suggestion you think will improve these documents.

In order to have time to prepare the final version we strongly recommend you to finish and send the final version of your chapter to the coordinator (fgamiz@ugr.es) not later than November 30th, 2005.

Chapter 1: SOI Materials

Responsible: SOITEC

Important recommendations for the SoA

In general, this chapter is well written. Please try to update the information if any technological progress has been produced in your field during the last months.

Chapter 2: Devices, Characterization

Responsible: IMEP

Important recommendations for the SoA

- 2.1 Chalmers: Missing weakness
- 2.3 IMEP: Missing weak points
- 2.5 IMEP: Missing weak points
- 2.6 UNIUD: Missing weak points
- 2.7 IMEP: Missing weak points
- 2.11 Chalmers: Missing weak points
- 2.14 X-FAB: Missing references, European Groups and Comments

- Chapter 2 list only strengths, no weaknesses. Please, correct this point.

In general, this chapter is well written. Please try to update the information if any technological progress has been produced in your field during the last months.

Chapter 3: Devices. Fabrication technology **VTT**

Responsible:

Important recommendations for the SoA

- 3.1.1: Missing Introduction
- 3.1.3 UGR: Missing conclusions and recommendations
- 3.1.6: is not included
- 3.2: is not included
- 3.3.3: is not included
- 3.3.2 UU: Missing strong and weak points
- 3.4 UU: Missing strong and weak points
- 3.5 and the contained points are not included
- 3.5. SOI MEMS Fabrication
 - 3.5.1. Deep silicon etching
 - 3.5.2. Buried oxide etching
 - 3.5.3. Wafer bonding
 - 3.5.4. Substrate engineering
 - 3.5.5. SOI-MEMS CMOS integration
- 3.6.3: is not included

- **Parts of Ch. 3 are missing (3.1; 3.1.6, 3.2, 3.3.3, 3.5, 3.6.3,...) !!!.**
- Missing strong and weak points in different parts of Chapter 3.
- Please try to update the information if any technological progress has been produced in your field during the last months.
- Add a more direct brief comparison of the status with the existing industry roadmap.
- Use illustrations.
- Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.
- Try to highlight the main challenges related to device characterization that the SOI community will face in a near future.

Important recommendations for the SoA

4.1 IME TUW: Missing strong and weak points

4.1.4. IME TUW: Accumulation Mode MOSFETs; is not included

4.2.1 & 4.2.2 Philips: Not complete (almost empty). It is necessary to complete all the sections.

4.3.1 LIVUNI: No abstract; Missing strong and weak points as well as conclusions and recommendations.

4.3.1 Philips: Not complete, please update the information.

4.4 SOI MEMS: No information about

4.4.1. RF-MEMS

4.4.2. Sensors

4.4.3. Integrated CMOS and MEMS

The only information included in point 4.4 is about the X-FAB technology. The goal of this report is to provide an extended review of the past and present of Silicon-on-Insulator technology. Please, keep in mind this idea while writing the SoA report.

4.6. 3-DIMENSIONAL INTEGRATION: Not included

4.7. Novel Devices – WUT: Missing strong and weak points as well as conclusions and recommendations, and European Groups.

- Parts of Ch. 4 are missing (4.4) !!!.

- Use uniform styles. Some sections describe in-house techniques (e.g. 4.4), while it should describe the situation worldwide.
- Missing strong and weak points in different parts of Chapter 4.
- Please try to update the information if any technological progress has been produced in your field during the last months.
- Add a more direct brief comparison of the status with the existing industry roadmap.
- Use illustrations.
- Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.
- Try to highlight the main challenges related to device fabrication technology that the SOI community will face in a near future.

Chapter 5: Devices. Simulation and modelling Responsible: UGR

Important recommendations for the SoA

5.2.1. Introduction to device modelling **Philips**: Lacking of conclusions and recommendations.

5.3 **UGR**: It is necessary to define points

5.3.1. Introduction

5.3.2. Types of circuit simulations

5.3.3. Analog circuit simulators

5.3.4. SOI models.

- Missing conclusions and recommendations at point 5.2.1.
- Please try to update the information if any technological progress has been produced in your field during the last months.
- Add a more direct brief comparison of the status with the existing industry roadmap.
- Use illustrations.
- Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.
- Try to highlight the main challenges related to device simulation and modelling that the SOI community will face in a near future.

Chapter 6: Reliability of SOI devices and circuits

Responsible: Philips

Important recommendations for the SoA

6.1. Wafer-level reliability Philips: Please, include the references and conclusions as text and not as attached files. Lacking of weak points.

Please, include the references at points 6.2, 6.3, 6.4, 6.5

6.4, 6.6 Philips: Lacking of weak points

6.5 Philips: Lacking of strong points.

6.7 Philips: Lacking of strong/weak points and references

6.8 Philips: Lacking of strong/weak points and references and abstract

- Parts of Ch. 6 are missing and overall very brief.

- Add a more direct brief comparison of the status with the existing industry roadmap ITRS.

- Use illustrations.

- Complete the missing chapters. Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.

- Try to highlight the main challenges related to device reliability from an industrial point of view.

Chapter 7: Devices. Non-conventional device concepts

Responsible: UGR

Important recommendations for the SoA

Not included:

7.1. Transport enhanced FETs

7.1.1. Strained Si, Ge, SiGe, SiGeC, SON or other semiconductor on SOI

7.2. Metallic gate FETs

7.3. Ultrathin body SOI FETs

7.4. Source and drain engineering

7.4.1. Metallic S/D junctions

7.4.2. Non-overlapping S/D junctions

7.5. Double gate devices

7.5.1. Ground plane SOI transistor

7.5.2- Philips: Too short, different fields have to be filled in.

7.5.3. Asymmetrical DGSOI transistor

7.5.4. Velocity modulation transistor

7.6.1. FinFETs UAB: Lacking of conclusions and recommendations

7.6.2. Vertical transistors, UAB: Lacking of conclusions and recommendations

7.6.3, 7.6.4 UAB: Lacking of conclusions and recommendations

7.7. UAB: Lacking of conclusions, recommendations and list of European groups

7.8. UAB: Lacking of conclusions, recommendations and list of European groups

- Parts of Ch. 7 missing and overall very brief !!!

- Add a more direct brief comparison of the status with the existing industry roadmap ITRS.

- Try to give the state-of-the-art in more quantitative form, e.g., values of mobilities, thicknesses, gate lengths.

- Use illustrations, add a list of abbreviations.

- Missing conclusions, recommendations and list of European groups in different parts of Ch. 7.

- Please try to update the information if any technological progress has been produced in your field during the last months.

- Add a more direct brief comparison of the status with the existing industry roadmap.

- Use illustrations.

- Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.

- Try to highlight the main challenges related to non conventional device concepts that the SOI community will face in a near future.

Important recommendations for the SoA

Not included:

8.3.2. Embedded DRAM

8.3.3. Other.

8.4.2. HR substrates and Crosstalk analysis; QUB: Lacking of conclusions, recommendations and list of European groups

- Parts of Ch. 8 missing and overall very brief. Most of the work has to be done.

- Add a more direct brief comparison of the status with the existing industry roadmap ITRS.
- Try to give the state-of-the-art in more quantitative form, e.g., values of mobilities, thicknesses, gate lengths.
- Use illustrations, add a list of abbreviations.
- Missing conclusions, recommendations and list of European groups in different parts of Ch. 8.
- Use illustrations.

Chapter 9: End-users & Industrial Applications

Responsible: CISSOID

Important recommendations for the SoA

- Please try to update the information if any technological progress has been produced in your field during the last months.
- Add a more direct brief comparison of the status with the existing industry roadmap.
- Try to give the state-of-the-art in more quantitative form, e.g., values of important magnitudes.
- Try to highlight the main challenges related to End-user and industrial applications that the SOI community will face in a near future.
- Use illustrations, add a list of abbreviations.

Roadmap

Important recommendations for Roadmap's elaboration.

Please use the following scheme when preparing your documents:

Comments/Introduction:

Brief introduction.

European Groups:

Indicate the main groups (labs/industry) working in the field where they have a lead position.

Strong Points:

Comment the points where Europe is a world leader or has a competitive position. Please, highlight which groups are in that position in order to be known by the SOI community.

Weak Points:

Comment the aspects where Europe is a follower of the technology developed in other places (indicate where).

Conclusions and Recommendations:

Potential development of the field. Interest of the field from a commercial point of view. Technical challenges that will be face in a near future.

Please, clearly indicate where Europe has to focus their economic and human resources and which technological options should be discarded.

Remember that this Roadmap is not similar to the ITRS. The report has to be written in an accessible way and it should contain clear, crisp conclusions and recommendations in each subfield.

A clear list of conclusions and recommendations is given about materials research (chapter 1). The same is expected in all the chapters. Therefore, please try to follow the same style as Chapter 1

Important recommendations for each one of the Roadmap Chapters

Chapter 1: SOI Materials

Responsible: SOITEC

This chapter is pretty well written.

Missing point 1.3

Chapter 2: Devices. Characterization

Responsible: IMEP

Missing points 2.6 (Electro-luminescence techniques), 2.13, and 2.14.

The whole chapter is still preliminary and too brief. Please, update and extend the contents.

Chapter 3: Devices. Fabrication technology
Responsible: VTT

Missing points dedicated to SOI MEMS Fabrication and Optical SOI technology.

Chapter 4: Devices. Physics
Responsible: UGR

4.1 missing conclusions and recommendations.

Missing points 4.2, and 4.5.

The whole chapter is still preliminary and too brief. Please, update and extend the contents.

Chapter 5: Devices. Simulation and modelling
Responsible: UGR

The chapter focused on modelling is elaborated quite well. Please, update and extend the contents

Chapter 6: Reliability of SOI devices and circuits
Responsible: Philips

The whole chapter is still preliminary and too brief. Please, update and extend the contents.

Try to indicate the needs of the industry.

Provide a direct brief comparison with the existing industry roadmap ITRS (in which way is this roadmap different).

Chapter 7: Devices. Non-conventional device concepts
Responsible: UGR

Missing points 7.2, and 7.4.

The area beyond CMOS has not been addressed yet.

The whole chapter is still preliminary and too brief. Please, update and extend the contents.

Chapter 8: Circuit Design
Responsible: UCL

Try to indicate the needs of the industry. Provide a brief summary comparison with the existing industry roadmap ITRS (in which way is this roadmap different).

Produce an overview of short term, medium term, and long term development needs (long term vs. short term; big impact vs. small impact).

Please, update and extend the contents.

Chapter 9: End-users & Industrial Applications

Responsible: CISSOID

Try to indicate the needs of the industry. Provide a brief comparison with the existing industry roadmap ITRS (in which way is this roadmap different).

Please, update and extend the contents.

Overall opinion & conclusions: All MB members included IMEC and LETI.