



### **Workshop 3 : Innovative memory technologies** Wednesday, June 24th 2009

#### **Contents**

The aim of this technical Workshop is to explore the progress obtained during recent years in semiconductor memory technologies. Several topics will be covered from short-term to long-term memory solutions. In particular, floating gate and charge-trap non-volatile memories for embedded or stand-alone applications, resistive memory technologies (as Phase-Change memories and OXide-based memories), three-dimensional integration approaches to increase memory density will be discussed. Also innovative ideas covering thin-film memories, molecular memories and new architectures will be presented. Invited papers will be given by main actors of the memory field (ST-Microelectronics, IBM, Numonyx, SAMSUNG). The workshop will be a good opportunity for all participants, from companies and academia, to share experience and exchange views on scientific and engineering achievements.

#### **Organization**

**Barbara de SALVO**, CEA LETI / MINATEC  
**Ludovic POUPINET**, CEA LETI / MINATEC



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# 11<sup>th</sup> Leti Annual Review

June 22<sup>nd</sup> - 24<sup>th</sup>  
2009



## Technical Program

Session		Speaker	Speaker Affiliation	Title of the Presentation
<b>8.30 am – Workshop Opening</b> <i>Chairs: B.DeSalvo, L.Poupinet (CEA/LETI)</i>				
<b>Session 1 : Charge-storage memories</b>				
<b>8.40 am</b>	<b>9.15 am</b>	<b>J.Devin</b>	<b>ST-Microelectronics</b>	<b>Invited contribution on embedded FLASH applications</b>
9.15 am	9.35 am	G.Molas	LETI	Charge-trap memories with high-k dielectrics
9.35 am	9.55 am	G.Gay.	LETI	Silicon nanocrystal and metallic nanoparticle memories
9.55 am	10.15 am	S.Bruyère	ST-Microelectronics	Overview of embedded 65nm Flash technology
10.15 am	10.35 am	R.Clerc	IMEP	eFlash TCAD and simulation
<b>10.35 am - Break (15')</b>				
<b>Session 2 : Resistive memories (1/2)</b>				
<b>10.50 am</b>	<b>11.25 am</b>	<b>R.Bez</b>	<b>Numonyx</b>	<b>Invited paper: "Phase Change Memory: State of the Art and Perspective"</b>
11.25 am	11.45 am	L.Perniola	LETI	PCRAM based on new materials
11.45 am	12.05 am	C.Muller	IM2NP	Electrical performances of NiO resistive switching materials
<b>12.05 am - Lunch break (2h)</b>				
<b>Session 2 : Resistive memories (2/2)</b>				
<b>2.00 pm</b>	<b>2.35 pm</b>	<b>C.Lam</b>	<b>IBM</b>	<b>Invited paper: "Storage Class Memory – Opportunities and Challenges"</b>
2.35 pm	2.55 pm	C.Vallée	LTM	OxRAM technologies
<b>2.55 pm - Break (15')</b>				
<b>Session 3 : 3D and novel memory ideas</b>				
<b>3.10 pm</b>	<b>3.45 pm</b>	<b>S.J.Baik</b>	<b>Samsung</b>	<b>Invited paper: "Limitation and Opportunity of High Density Flash Memories"</b>
3.45 pm	4.05 pm	T.Ernst	LETI	SOI technology & 3D memory architectures
4.05 pm	4.25 pm	P.Fazan	Innovative Silicon Inc.	ZRAM
4.25 pm	4.45 pm	P.Mazoyer .	ST-Microelectronics	Thin-film memories
4.45 pm	5.05 pm	J.Buckley	LETI	Molecular memories
5.05 pm	5.25 pm	Weisheng Zhao	IEF	Nanocomponents based neuromimetic memories
<b>5.25 pm – Conclusions</b>				



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## Abstracts

### **New embedded NVM architectures for Secure & Low Power Microcontrollers.**

Secure & general purpose Microcontrollers are requesting new e-NVM implementations to address the need of software flexibility with large memory size , thin erase granularity , while keeping a high level of robustness and low manufacturing cost"

*Jean Devin, R&D director for the Microcontrollers, Memories & Smartcards (MMS) Group within STMicroelectronics.*

### **Phase Change Memory: State of the Art and Perspective**

Chalcogenide materials have recently attracted attention for applications in the semiconductor industry, since the phase change properties can be used to make Non-Volatile Memory (NVM). In late 90th the concept of Phase Change Memory (PCM) has been presented again with the aim to build memory devices able to replace and to go beyond the industry standard NVM. Since then many industries interested in the semiconductor memory started R&D projects to work on the PCM technology, but only very few has been able to obtain significant results to sample PCM products to customers. This is possible only if basic physics mechanisms are fully understood and if the behavior of the materials, either intrinsic or extrinsic, is deeply analyzed. This has been true in the Flash memory development with the deep study and understanding of the tunnel silicon dioxide properties and its wear-out mechanisms. This will be true in a new memory concept, like the PCM, where the material properties of the chalcogenide materials are fundamental for the technology validation and its scalability.

*Roberto BEZ, Fellow, R&D - Technology Development, Numonyx*

### **Storage Class Memory – Opportunities and Challenges**

The ultimate goal of emerging memory technology researchers and developers is to devise a universal memory to replace all memories types including the magnetic storage devices, commonly know as the Hard Disk Drive (HDD). The presumptions are that Storage Class Memory (SCM) using solid state memory without moving parts will consume less power and more reliable than HDD. In this presentation, we will examine the opportunities and challenges in the development SCM

*Chung H Lam, Ph.D, Distinguished Engineer, Manager, Phase Change Memory, IBM T J Watson Research Center*

### **Limitation and Opportunity of High Density Flash Memories**

From the scientific point of view, fundamental scaling issues of flash memory will be reviewed and scaling limitation will be discussed. Possible transition of device structures and materials, as well as direction of unit processes will be given to show opportunities for high density flash memories.

*Seung Jae Baik, Principal Engineer, SAMSUNG*



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