Gossamer

Gigascale Oriented Solid State flAsh Memory for EuRope

Industrial partners

NUMONYX, Italy *(1)*
Qimonda, Germany *(2)*
ASM Europe BV, Belgium
Active Technologies, Italy
Jordan Valley

Management consulting

Alma Consulting Group, France

Research partners

IMEC, Belgium
CNR-IMM MDM, Italy
Tyndall Research Centre, Ireland
IUNET, Italy
University of Freiberg, Germany *(3)*
Fraunhofer CNT, Germany
University of Braunschweig, Germany
NAMLAB Dresden *(4)*

(1). Now a MICRON company
(2). Until 31/3/2009
(3). Until 31/12/2009
(4). From 1/1/2010

A European Integrated Project supported through the Seventh Framework Programme
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Contract number: 214431

GOSSAMER An Integrated Project under FP7

Objectives:

To develop the Charge Trapping Technology for very high density Non Volatile Memories for mass storage, targeting the 22 nm technology node.

Start date: January 1st, 2008

Duration: 3 years

Memory for the mobile World

During the last 15 years, ICTs have provided a number of radically new devices / techno-toys that have improved the daily life of the EU citizen: mobile phone, digital camera, MP3 players, PC, PDA, credit cards, video on discs, flat screen, HD TV, fast communications (ADSL)…

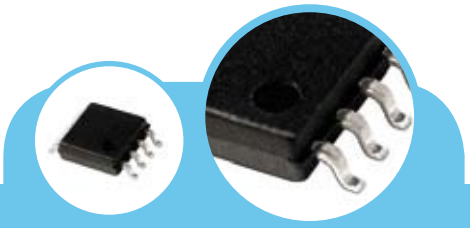
The need of more and more "memory" is shared by all applications of ICTs such as enhancing life comfort and security, leisure, education, business and improving work productivity.

At the moment there seems to be no sign for a slowing down of memory requirements: in spite of the doubling of memory density every 18 months, the diffusion of broadband communication and digital appliances, and the constant demand for better quality of images and sound, is creating an ever increasing need for large memories in a variety of new media.

Solid-state memories are the preferred solution for mobile applications. Their main advantages are the use of consolidated technology, the lack of any mechanical parts, which results in stronger ruggedness, lighter weight, smaller form-factor, better reliability and, above all, lower power dissipation.

And solid-state mass-storage today means NAND Flash memories

What are Flash memories?



Flash memory is non-volatile computer memory that can be electrically erased and reprogrammed. It is a technology that is primarily used in memory cards and USB flash drives for general storage and transfer of data between computers and other digital products. Flash memory is non-volatile, which means that no power is needed to maintain the information stored in the chip. (Wikipedia)

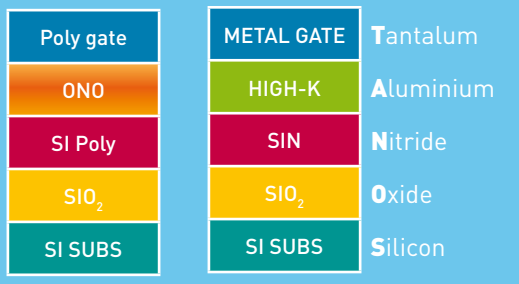
Pushing the limits of Flash

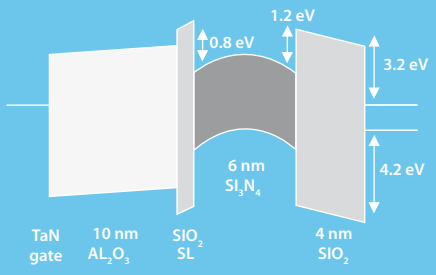
NAND Flash is by far the dominant technology for solid-state mass-storage. However, the floating gate concept is predicted to face technological limits around the 32nm node. The main physical limits that prevent further scaling of the cells are:

- cell to cell interference, due to the parasitic capacitive coupling among neighbouring floating gates;
- low coupling ratio with the control gate, which results also in a small stored charge.

From discrete to continuous trapping layers

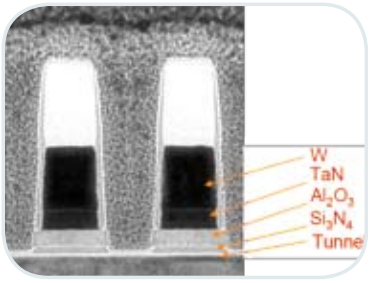
The most promising option to overcome these scaling limitations, while retaining the very high integration density of NAND Flash architecture seems to be the replacement of the conventional floating gate with a charge trapping layer.

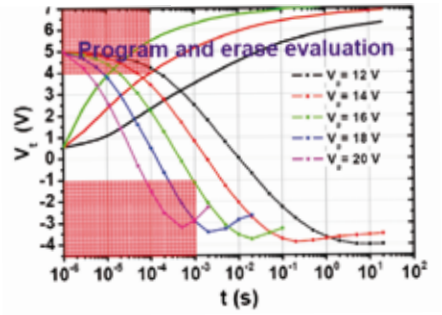




From basic cell studies...

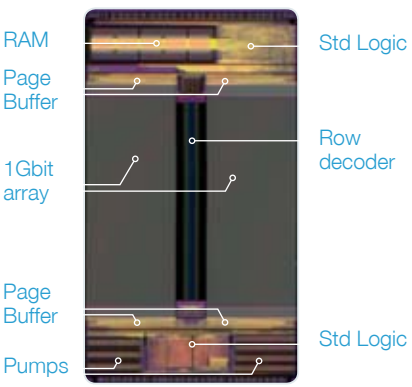
In the first years of the project material and cell architectures were developed leading to the characterization of functional mini-arrays.
Optimized stack composition and programming conditions were defined thus leading to a second more ambitious target.





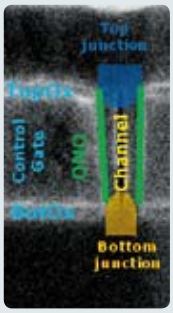
...to a large scale demonstrator

Fully functional samples have been obtained with good programming performances and acceptable relability. Innovative technology steps were introduced for the first time on a large scale, like **barrier engineered tunnel dielectric**, which showed the capability for further enhancing device performances

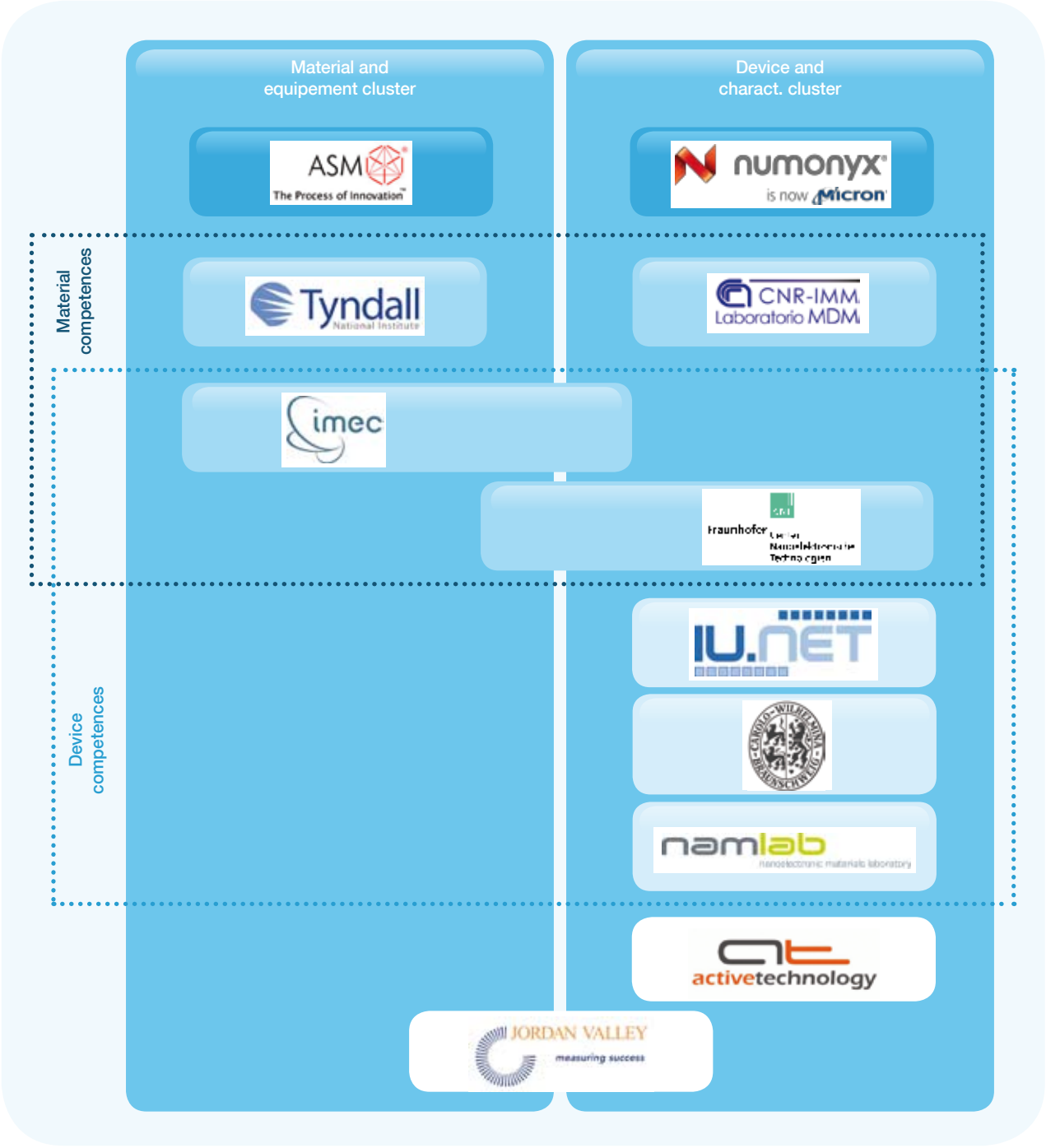


Moving 3-D

The next step will be the development of architectures suitable for the 22nm node, exploiting also the capability of 3D integration, either with multilayer memories or with vertical cells



Consortium



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