SYnthesis and functionality of chalcogenide NAnostructures for PhaSE change memories

Fact Sheet

Project Information

SYNAPSE

Grant agreement ID: 310339

Project website

Status
Closed project

Start date 1 December 2012

End date 30 November 2015

Funded under
FP7-NMP

Overall budget € 2 839 238,51

EU contribution € 2 056 348,36

Coordinated by
CONSIGLIO NAZIONALE DELLE RICERCHE
Italy

Objective

The SYNAPSE project initially aimed at the metalorganic chemical vapor phase deposition (MOCVD) and study of chalcogenide single material, (core) and double material (core-shell) nanowires (NWs), for innovative multi-level phase change memories (PCM). If Ge-Sb-Te is the most studied material for PCM applications, In-based materials, like In-Sb-Te or In-Ge-Te alloys, are also promising, since they are featured by low reset current and high crystallization temperature, paving the way for performing data storage devices even in the automotive field. At the same time, a great attention is currently devoted to the chance to downscale PCM cells by employing chalcogenide NWs. In SYNAPSE, Ge-based and In-based single material (SM-NWs) will be first deposited by MOCVD on different substrates and using
different bottom-up approaches, the vapor-liquid-solid (VLS) and the selective area growth (SAG). SM-NWs were originally expected to be in-situ MOCVD-coated by other phase change chalcogenides, to obtain core-shell nanowires (CS-NWs), both free-standing and buried in template matrix. Different material combinations (Ge-Sb-Te/In-Sb-Te/In-GeTe) had to be explored in the realization of the CS-NWs, in order to expand the memory level operational features of the obtainable PCM devices. Due to some delays and the impossibility to ask for an extension, a project redefinition during the second reporting period was necessary, so that the objective of obtaining core-shell nanowires was dropped, along with the optimization of conformal chalcogenide layers. The important goal of exploring NWs of different chalcogenide alloys, including Ge-based and In-based telluride remains, for their application to PCM devices both as single nanocells and in ordered arrays. This will anyway represent an important contribution to the achievement of downsized and low-power consumption non-volatile memory cells.

The NW synthesis will be therefore supported by the development and test of precursors for MOCVD. A detailed study of the NW phase switching behavior (reversible amorphous-crystalline transitions) will be carried out and correlated. Special attention will be devoted to the investigation of electrical and thermal properties of the NWs, their phase formation/crystallization dynamics, size-dependent effects and structural/chemical composition. Experimental work will be supported by theoretical modeling and simulation of both crystallization dynamics and electro-thermal behavior. Another significant change in the project redefinition is represented by the termination of one industrial partner (Micron), whose planned activity is expected to be partly compensated by the remaining partners and by the involvement of an external industrial company of the field, participating to project meeting(s). The SYNAPSE consortium is finally formed by 6 participants (5 academic/research centers and 1 industry) from Italy (2), France (2), Germany (1) and Ireland (1).

Programme(s)

Topic(s)

Call for proposal

FP7-NMP-2012-SMALL-6

Funding Scheme

CP-FP - Small or medium-scale focused research project
Coordinator

CONSIGLIO NAZIONALE DELLE RICERCHE

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Activity type
Research Organisations

EU contribution
€ 576 011

Contact the organisation

Administrative Contact
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Participants (6)

Air Liquide electronics Systems

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Activity type
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Activity type
Research Organisations

Contact the organisation

Administrative Contact
Volker Marx (Mr.)

Numonyx Italy Srl
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**Contact the organisation [link]**

**Administrative Contact**
- Seminara Manuela (Dr.)

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**Website [link]**

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- Christophe Giraud (Mr.)

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**Website [link]**

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Education Establishments

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Francesco Maggio (Mr.)

Last update: 2 August 2019
Record number: 106204

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