IHP coordinates Horizon 2020 project R²RAM – Radiation Hard Resistive Random-Access Memory

Frankfurt (Oder). R²RAM aims to realize a strong methodology for the development and design of a radiation hard non-volatile memory technology by using standard CMOS silicon processing. Since standard silicon memories, such as flash memories tend to fail under irradiation, a new approach is envisaged: the development of a specific memory technology, so called resistive random-access memory (RRAM), which is able to sustain heavy ions and other charged particles. Therefore, IHP coordinates the Horizon 2020 project R2RAM. Starting in 2015, the partners CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LA NANOELETTRONICA (Italy), RedCat Devices Srl (Italy), JYVASKYLÄN YLIOPISTO (Finland), and IHP want to find a solution in the project term of two years.

Semiconductor memories, among rad hard integrated circuit scenario, are one of the most critical topics for space applications. Actually both volatile and nonvolatile memories, excluding few exceptions, are integrated using standard processes and standard architectures. This means that the final device is typically at least Rad tolerant and not Rad Hard and failure during mission is avoided using Error Correcting Code techniques including redundancy at the board level. The basic goal of the project is to give a methodology for the development of a new rad-hard nonvolatile RRAM memory with high-performance features like good retention, re-programmability and cycling, and realize a prototype (1Mbit RRAM memory) in order to validate the approach. (www.r2ram.eu)

To take up these challenges, the consortium of this project examined and selected one new technology with a potential to bridge that technological gap to enable new non-volatile memory for space applications, the Resistive RAM (RRAM) Technology. The switching effect of RRAM devices is caused by chemical Redox-reactions, therefore, radiation effects like total ionizing dose and single event effects don’t affect the switching mechanism.

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About IHP:
The IHP is an institute of the Leibniz Association and conducts research and development of silicon-based systems and ultra high-frequency circuits and technologies including new materials. It develops innovative solutions for application areas such as wireless and broadband communication, aerospace, biotechnology and medicine, automotive industry, security technology and industrial automation. The IHP employs approximately 300 people. It operates a pilot line for technological developments and the preparation of high-speed circuits with 0.13/0.25 µm BiCMOS technologies, located in a 1000 m² class 1 cleanroom.

About Redcat Devices:
RedCat Devices (RCD) is a privately held european fabless semiconductor company involved in several fields of research concerning memories (volatile and non volatile), analog components (ADCs, DACs) and standard digital libraries for special applications. RCD experience comes from high density memory design (NAND and NOR) and analog electronics (Flash, Delta-Sigma) for consumer applications and integration of silicon devices (ASICs) in the field of aerospace. In the last eight years RCD has been involved in several R&D projects including FP7 262890 SkyFlash in the role of coordinator. RCD is a TowerJazz IP Solutions Partner for radiation hardened libraries and volatile memories (SRAMs) with a specific focus on 180nm technology node.

About the Consorzio Nazionale Interuniversitario per la Nanoelettronica:
The “Consorzio Nazionale Interuniversitario per la Nanoelettronica” (IUNET, Italian Universities Nano-Electronics Team), is a non-profit Organization, aimed to lead and coordinate the effort of the major Italian university teams in the field of silicon-based nanoelectronic device modelling and characterization. Current members of IUNET are the Universities of Bologna, Calabria, Ferrara, Modena e Reggio Emilia, Padova, Pisa, Udine, Roma “La Sapienza” and the Politecnico of Milano. They offer renowned and complementary expertise in the fields of modeling, simulation, design, and characterization of CMOS-based, memory and Beyond CMOS nanometer-size electronic devices.

About the University of Jyväskylä:
The University of Jyväskylä (JYU) with its seven faculties, 2600 employees and 16 000 students is one of the largest universities in Finland. It has also EU’s HR Excellence in Research status. Department of Physics (JYFL) of the university belongs to the Faculty of Mathematics and Science. Its research covers theoretical and experimental subatomic and material physics and their applications. Accelerator laboratory of JYFL has operated very successfully as one of the Large Research Access Infrastructures in the FP4 - FP7 programmes of the EU since 1996 (ENSAR for 2013-2014) and acted as a FP5 Marie Curie Training Site. Since 2005 laboratory’s RADIation Effects Facility, RADEF has been qualified to one of the External European Component Irradiation Facilities of European Space Agency, ESA.