



PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 38th cycle

**PNRR_352 Research Field: SURFACE MODIFICATION AND METALLIZATION PROCESSES
FOR MEMS AND ON CHIP BATTERIES**

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

**Motivation and objectives of the research
in this field**

The scope of the work is the development of technologies for the surface modification and metal integration in MEMS silicon devices and for on chip batteries. This will open new functionalities and integration processes into existing production lines. The implementation of silicon based microdevices and electrochemical energy storage devices is fully in line with the topics targeted by DM n.352 (09/04/2022), Art.s 1.7 and 6.4a in terms of sustainability and energy transition. New materials for advanced MEMS technology and on chip batteries accomplished the needs in the PNRR for innovation, digital transition and transformation, and sustainable mobility.

Micro-Electro-Mechanical Systems, conceptualized in the 1960s and commercialized in the 1980s, are enabling several technologies and playing a central role in the boom of the Internet of Things. As consumer electronics gets loaded with high-performance devices, the stress on energy efficiency is growing. Moreover, researches on the Internet of Things (IoT) have been pervasive in both the academic and industrial world. IoT based on a variety of sensors is seen as cornerstones to digital transformation in the industry, as in the electric mobility. The outcomes of the proposed research aimed to produce implemented MEMS sensors and on chip batteries will provide a contribution to such transformation.



<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research activities will include the evaluation of new materials and functionalization for the integration with MEMS technology and for the design of on chip batteries. The use of electrochemical techniques and structural/morphological analyses will be part of the activities for the evaluation of the device performances. This scenario motivates doctoral multidisciplinary research in the field of silicon microdevices and energy storage.</p> <p>The proposed research will gain from knowledge coming from various disciplines, from material science to microfabrication, from electrochemical processes to sensors integration, answering to the needs of innovation and new expertise and skills for companies involved into the semiconductor industry as strategic area for our country.</p>
<p>Educational objectives</p>	<p>The educational aims are:</p> <ol style="list-style-type: none"> 1. amplify supported PhD research experience and favour co-operative research experience at possible partners; 2. elevate the educational experience by creating a highly-visible center for MEMS technology and energy storage device technology.
<p>Job opportunities</p>	<p>The introduction of new materials, processes and devices in MEMS technology will implement the number of applications of these devices. Job opportunities for an expert PhD in this field are expected in the private and academic sector.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 1 Associated Professors 3 Assistant Professors 8 PhD Students</p>
<p>Name of the research directors</p>	<p>Prof. Luca Magagnin</p>

Contacts

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www.cmic.polimi.it/en/ricerca/elenco-gruppi-di-ricerca/seelab/



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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	0

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	STMicroelectronics - Via Paracelso nn 16/18/20 - Agrate Brianza - 20041, Italy : www.st.com
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	The Bristol Centre for Nanoscience and Quantum Information, University of Bristol Bristol, BS8 1FD United Kingdom (www.bristol.ac.uk/nsqi-centre/)
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Confidentiality: since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the funding company. Upon acceptance of the scholarship, the beneficiary must sign a specific commitment.

Individual budget for research (during the 3 years): about 5.400 euro.

Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial of for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.