



# PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 39th cycle

**PNRR 117 Research Field: SUSTAINABILITY-PROPERTY NEXUS OF STEEL-BASED MATERIALS AND PRODUCTS (ACRONYM SUSTEEL)**

**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**

Promote the circulation of knowledge and skills between research and the production system and enhance the results of research through a virtuous process of contamination is essential to ensure the competitiveness of our Country, still more in the current scenario of transitions, green and digital. The promotion of innovation cannot, therefore, disregard a strengthening of the relationship between research and the production system. Accordingly, mobility programs between the academic world and industry targeted to technology transfer can facilitate the transition from fundamental to applied research and to market. In particular SUSTEEL, perfectly fits the EU Green Deal objective 4. Digital, industry, aerospace, as well as the Thematic Objective OT3. Mobilizing industry for a clean and circular economy of PNRR 21-27. More in details SUSTEEL places in the major area of research and innovation 5.4.6 Innovation for the manufacturing industry, and more precisely in: Articulation 1. Circular, clean and efficient industry Articulation 2. Inclusive industry, Articulation 3. Systemic sustainability of products, processes, services, Articulation 4. Resilient Industry, Articulation 5. Competitive industry. Expected outcomes are: development, characterization and modeling of new materials/products; design of new technologies and factory systems for the creation of new products and the improvement of existing ones; support to collaboration between research and industry; enhancement of National research



	<p>infrastructures (e.g., advanced laboratories for experiments, dedicated sites to innovative technologies of production, assembly and integration of the manufacturing industry); accelerating the birth of new businesses, also through spin-offs shared by universities, industries and research centres; transition to processes, systems and models for a production and distribution of products and product-service solutions closer to customers and final consumers. Expected impact: increase the competitiveness of steel industry by reducing the energy consumption and increasing the sustainability of their products.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research aims to assess the relationship between sustainability in its largest meaning (three-pillars theory: environment, society and governance) and materials performances of steel-based products, particularly those manufactured with a high recycled content, i.e. by the use of metal scrap. For this reason, the involvement of Cogne Acciai in Aosta, a renown Italian steel production plant, will give an added value to the project. Indeed, a consistent share of the PhD will be spent in the Aosta Cogne Plant. The methodology adopted to assess the sustainability of steel-products is the Life Cycle Sustainability Assessment (LCSA), which relies on ISO 14040-14044 standards for LCA and on ISO 14067 for Carbon Footprint. In addition, there is on the way a new standard for Social Life Cycle Assessment (ISO/CD 14075 - Principles and framework for social life cycle assessment), which will support social assessment as well. For materials properties, a wide range of mechanical and microstructural properties are included so that a nexus between steel-based products and their sustainability can be estimated. The creation of an ad-hoc tool that might support the steel industry to assess this nexus will be developed as part of the PhD project, by using two advanced digital open-source tools: Python programming language (<a href="https://www.python.org/">https://www.python.org/</a>) and Brightway (<a href="https://documentation.brightway.dev/en/latest/">https://documentation.brightway.dev/en/latest/</a>).</p>
<p><b>Educational objectives</b></p>	<p>1. Ability to manage projects in circular economy</p>



	<ol style="list-style-type: none"> <li>2. Skill in developing sustainable materials and products with tailored properties</li> <li>3. Capability to support processes for innovation and technology transfer in new sectors</li> <li>4. Capability to foster Circular Communities development</li> <li>5. Capability to answer to environmental topics and challenges</li> </ol>
<b>Job opportunities</b>	<p>There is an increasing request of highly specialized technicians and professional figures able to:</p> <ol style="list-style-type: none"> <li>1. Design new sustainable steel-based materials</li> <li>2. Design tailored materials for special application</li> <li>3. Work in greener industrial steel-related technologies</li> <li>4. Assess the sustainability of industrial productions and contributing to the sustainability report</li> <li>5. Manage the ESG reporting</li> </ol>
<b>Composition of the research group</b>	1 Full Professors 2 Associated Professors 2 Assistant Professors 6 PhD Students
<b>Name of the research directors</b>	Prof. Giovanni Dotelli

<b>Contacts</b>	
<p><b>Confidentiality - Agreement with company:</b> 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. <b>Individual budget for research</b> (5.700 euro): 1<sup>st</sup> year: 1.900 euro; 2<sup>nd</sup> year: 1.900 euro; 3<sup>rd</sup> year: 1.900 euro <b>Teaching assistantship (availability of funding in recognition of supporting teaching activities by the PhD student):</b> there are various forms of financial 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. The student will have the use of computer and desk both in the university and in the company. There is a support for educational activities, i.e. funding for participation in courses, summer schools, workshops and conferences. He will operate under the supervision, but in autonomy, of the academic research director and the research director of COGNE, the Company involved in the project. Materials for Energy and Environment (MAT4En2) group has a long experience in training PhD researchers. Its laboratories typically host undergraduate and graduate students, carrying out research work for their thesis, as well as postdoctoral fellows from</p>	



abroad, participating in research programs funded by the European Union and by other international agencies. The group cooperates with Italian and foreign universities and research centers. For the duration time of the PhD, the student will be trained to make him/her to develop decisional and coordinating capacities on research approach, time compliance, capacity to quickly answer to changes if required. He/her will be encouraged to submit results to the scientific community with presentation of the research in both National and International meetings, and publications in international peer-reviewed and open-access journals. At the best of his/her experience, he/her actively will contribute to communication/dissemination actions; therefore, he/her will attend suitable stages (for instance local meetings), for training in the presentation of news of scientific character to learn the professional attitude for divulging scientific concepts to a large audience. The direct experience of dissemination (seminars, meetings) with the not-peered social communities (school, citizens) will constitute a valuable training in communication science and environmental problems at a not-academic level. The PhD student will be asked to collaborate and participate to financed projects to develop decisional and coordinating capacities regarding, for instance, research approach, time compliance, capacity to answer to changes required by feedback from the experimental results.

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	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Cogne Acciai Speciali S.p.A. Via Paravera, 16, 11100 Aosta (AO) - ITALY <a href="https://www.cogne.com/">https://www.cogne.com/</a>
By number of months at the company	12
Institution or company where the candidate will spend the period abroad (name and brief description)	Max Planck Institute for Iron Research GmbH, Düsseldorf, Germany Max-Planck-Straße 1, 40237 Düsseldorf, Germany <a href="https://www.mpie.de/2281/en">https://www.mpie.de/2281/en</a>
By number of months abroad	6

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

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