



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**PNRR 118 TDA Research Field: NEW GENERATION OF LEAD-FREE STEELS WITH
IMPROVED PROPERTIES AND LOW ENVIRONMENTAL IMPACT**

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 PNRR plan is an extraordinary and outstanding occasion to innovate industrial tissue and increase current and future competitiveness of Italian industry. Such goal can be obtained improving competencies and knowledge in all fields that are nowadays fundamental for efficiency and sustainability. The present research aims to improve chemical composition, microstructure and production processes of new developed lead-free steel for engineering applications. They are intended to obtain improved physical, metallurgical and mechanical properties to access markets where sustainability and recycling are main topics. Moreover, the optimization of whole manufacturing process does not mean a simple enhancement of material quality, but also a reduced waste of resources and carbon footprint. For this reason, upgrading product properties will be associated to process sustainability and environmental impact.

**Methods and techniques that will be
developed and used to carry out the
research**

Improvement in product performance and quality will require a careful material control from steel plant to end user. Physical, metallurgical and mechanical properties are closely related to the whole manufacturing cycle, i.e. steelmaking procedures, hot and cold rolling parameters, choice of proper heat treatment. For such reasons, characteristics of lead-free steel will be studied step by step using chemical analysis, mechanical and technological tests, coupled with fractographic and metallographic observations.



	metallographic observations.
Educational objectives	The Ph.D. candidate will be involved in all technical discussions and choice of process parameters able to obtain the desired physical, mechanical and metallurgical properties. This will improve candidate hard skills, contemporary shaping its aptitude to team working and project management. The attention to the whole production cycle will improve candidate knowledge in steelmaking processes, hot and cold plastic deformation, heat treatments and machinability with the aim to understand the relationship between metallurgical characteristics and final product properties. Final result is the development of a professional figure able to manage different aspects of a real industrial process, from raw materials to customer service.
Job opportunities	Skills, knowledge and experience that will be developed in this Ph.D programme will provide the candidate very interesting abilities for companies operating in mechanical-metallurgical fields. Research activities of this Ph.D programme will be performed also in collaboration with other Italian Universities and International Institutions. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to Master of Science holders in the same field.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 3 PhD Students
Name of the research directors	Prof. Marco Boniardi

Contacts
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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	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Trafilix Industries
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	TRAFIL CZECH
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation in courses, summer schools, workshops and conferences) for a total amount of euro 5.707,13.</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. There are various forms of financial aid 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 regulations.</p>