



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

THEMATIC Research Field: ADVANCED MATERIALS AND SUSTAINABLE PROCESSES

| Monthly net income of PhDscholarship (max 36 months) |
|--|
| € 1500.0 |
| 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 | <p>The demand arising from technological innovations driven by the uptake of new manufacturing processes and improved product performance, is strongly motivating the development of innovative structural and functional materials with advanced and new properties.</p> <p>Future materials need to be designed/optimized according to their specific processing route (e.g. materials for additive manufacturing), need to possess specific thermal and physical properties to fulfill special functions and could preferably show variation of their properties within the volume of a single components (e.g. multi-materials, gradient 3D lattices, metal-ceramic composites).</p> <p>In addition, cost-effective and sustainable criteria need to be preferred for the selection of the of the alloying elements and the manufacturing route. The research field of advanced metallic materials is really vibrant, several research projects are available within this frame and perspective job opportunities are abundant.</p> <p>Details about the specific topics to be faced during the PhD will be supplied on request.</p> |
| Methods and techniques that will be developed and used to carry out the research | <p>The Material research group has expertise on the design processing, microstructural and mechanical characterization of advanced metallic alloys.</p> <p>The methods to be used will involve Thermodynamic</p> |



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| | <p>modelling of alloy microstructure, tools for experimental analyses on phase and microstructure analyses (optical and electron microscopy, EBSD, XRD, DSC,) and mechanical characterization among others by tensile testing, fracture toughness, fatigue testing, creep.</p> <p>For more details about available infrastructures, see: https://www.mecc.polimi.it/us/research/departmental-laboratories/.</p> |
| Educational objectives | <p>At the end of the PhD cycle the candidate will be able to define, design and carry out original research programs by working in a team or leading a research group in the field of advanced materials.</p> |
| Job opportunities | <p>Job opportunities are foreseen at national and international academic institutions, high-tech companies and SMEs involved in innovation and technical development, especially those already sharing research activities with the Materials groups at PoliMi.</p> <p>Employment statistics of PhDs can be found at https://cm.careerservice.polimi.it/en/employment-statistics/.</p> |
| Composition of the research group | <p>4 Full Professors 7 Associated Professors 2 Assistant Professors 10 PhD Students</p> |
| Name of the research directors | <p>Prof. Maurizio Vedani</p> |

| Contacts | |
|---|--|
| <p><i>E-mail:</i> maurizio.vedani@polimi.it <i>Phone:</i> 02 2399 8230 .</p> <p>For questions about scholarship/support, please contact phd-dmec@polimi.it.</p> | |

| 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 |
|---|
|---|



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|----------------------------|---------|
| Amount monthly | 750.0 € |
| By number of months | 6 |

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

Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation to courses, summer schools, workshops and conferences) for a total amount of euro 6.114,50.

Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for visiting periods abroad for up to 6 months (approx. 750 euro/month-net amount).

Funding for teaching assistantship is availability in recognition of supporting teaching activities by the PhD candidates. 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.



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

THEMATIC Research Field: HYDROGEN-BASED ELECTRIC ARC FURNACE DUST REDUCTION FOR ZN AND FE RECOVERY

Monthly net income of PhDscholarship (max 36 months)

€ 1500.0

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 | Exploitation of hydrogen for the greening of Waelz process with the aim of a carbon neutral recover of Zn and Fe from EAF dusts. |
| Methods and techniques that will be developed and used to carry out the research | <ul style="list-style-type: none"> •Evaluation of the European steelmaking and ferrous foundry industries in terms of availability of Zn-containing dusts; •Characterization of Electric Arc Furnace dusts by chemical and crystallographic analysis; •Characterization of reduction products (ZnO, DRI and other by-products) by chemical, crystallographic and microstructural analysis; •Comparison between traditional and H₂-based Waelz process in terms of ZnO productivity, emissions, slag production and energy consumption. |
| Educational objectives | Improvement of the main skills in characterization of materials by in-depth application of analytical methods based on X-ray (XRF, XRD) and Optical emission (ICP, OES) spectroscopy; development of screening methodology for assessing the treatment feasibility of a specific dust for maximizing the yield of valuables extraction. |
| Job opportunities | The developed skills will be applied in several fields: |



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| | <ul style="list-style-type: none"> • metallurgical industries; • steelmaking industries; • process modelling. <p>The research activities are embedded within the Horizon Europe project "Dust2Value - Pioneering Sustainable Recovery in Steelmaking: Hydrogen-Based Technology for Byproduct Management", G.A. 101138742, funded by the European Union.</p> <p>The research activities are conducted at the Department of Mechanical Engineering, Politecnico di Milano. Also cooperating in the research activities are: MontanUniversitat Leoben; Befesa Steel R&D; Mal Metallbau Anlagenservice - Leitungsbau GmbH; Georgsmarienhutte GmbH; InsSyro NV; Befesa Steel Services.</p> |
| Composition of the research group | 1 Full Professors 5 Associated Professors 1 Assistant Professors 4 PhD Students |
| Name of the research directors | Prof. Carlo Mapelli |

| Contacts | |
|--|--|
| For questions about scholarship/support, please contact phd-dmec@polimi.it . | |

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