



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: GRADED MULTIFUNCTIONAL METALLIC AND HYBRID  
MATERIALS**

**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

Innovative materials are more and more requested to react to external stimuli by providing a proper behaviour, that is, a proper set of properties. In this sense, they can be considered as 'smart materials'. The target behaviour can be met both by single or multiphase materials, with a homogeneous or inhomogeneous phase arrangement. The specific material response can be tailored to offer different behaviour to similar homogeneous components or to obtain the target behaviour by a graded material with locally modulated composition/structure/response. In both cases there is the need to identify design/processing/property correlations and to exploit them. These materials often require specific design methods (e.g. thermodynamics-based ones) and specific processing route (e.g. rapid solidification, powder metallurgy, additive manufacturing, plastic deformation processing, heat treatment cycles) to meet the proper phase distribution, properties, arrangement. Several research projects are available within this frame. Details about the specific topics will be supplied on request.

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

The Material research group has expertise on microstructural and mechanical characterization of advanced metallic alloys. The methods to be used will involve thermodynamic modelling, tools to identify phase arrangement and model properties, tools for experimental analyses on phase and microstructure analyses (optical and electron



	phase and microstructure analyses (optical and electron microscopy, EBSD, XRD, DSC, ...), mechanical characterization ( e.g. tensile testing, fracture toughness, fatigue testing, creep) and physical properties (e.g. thermal, electric). For more details about infrastructures, see: <a href="https://www.mecc.polimi.it/us/research/departmental-laboratories/">https://www.mecc.polimi.it/us/research/departmental-laboratories/</a> .
<b>Educational objectives</b>	At the end of the PhD cycle the candidate will be able to use and combine methods and technologies for material design, processing and multifunctional characterization. The candidate will be thus able to carry out original research programs by working in a team or leading a research group in the field of smart materials.
<b>Job opportunities</b>	Job opportunities are foreseen at national and international academic institutions, high-tech companies and SMEs involved in innovation and technical development. Our last survey on MeccPhD Doctorates highlighted a <b>100% employment rate</b> within the first year and a <b>35% higher salary</b> , compared to Master of Science holders in the same field.
<b>Composition of the research group</b>	4 Full Professors 7 Associated Professors 2 Assistant Professors 10 PhD Students
<b>Name of the research directors</b>	Prof. Elisabetta Gariboldi, Prof. Maurizio Vedani

<b>Contacts</b>
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For questions about scholarship/support <a href="mailto:phd-dmec@polimi.it">phd-dmec@polimi.it</a>

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

<b>Scholarship Increase for a period abroad</b>	
Amount monthly	700.0 €
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 in courses, summer schools, workshops and conferences) for a total amount of euro 5.707,13.

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 periods up to 6 months (approx. 700 euro/month - net amount).

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.