



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

**THEMATIC Research Field: COLD SPRAY COATING AND ADDITIVE MANUFACTURING  
SOLUTIONS FOR THERMAL MANAGEMENT**

**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

Cold spray as a solid state deposition method is finding its way in different industrial sectors, mainly for offering surface coating solutions and repair of damaged parts. However, cold spray has many attractive properties for being considered also as an additive process for free standing 3D parts (high deposition rate, no need of protected atmosphere, high flexibility in mixing different powders, ...). The objective of this project is to develop deposition technologies using specific powder customized for thermal management. Finite element models and experimental approaches will be used to find the suitable deposition parameters and tune the response of the cold spray deposits; the latter will be assessed through detailed mechanical and thermal characterization. The results will be compared with those obtained from other additive manufacturing methods.

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

The development of the thesis includes both numerical simulations (FEM and other methods) of the process and deposited materials under working conditions of interest as well as experimental cold spray deposition, by considering different parameter combinations according to the numerical simulation results. Finally, an accurate physical, thermal and mechanical characterization of the deposited materials will be performed to find the most



	efficient set of deposition parameters.
<b>Educational objectives</b>	The aim of the thesis is to educate an expert in cold spray deposition for coating and additive manufacturing, able to manage research and innovation in this field, developing skills and attitudes that can be translated in different industrial fields. The candidate will also develop knowledge and skills in material characterization and in numerical simulations requested for a correct and competitive application of deposition techniques.
<b>Job opportunities</b>	<p>The research activity is carried out within the Horizon Europe-EIC collaborative research project <b>ThermoDust</b> (A paradigm shift for the future's thermal management devices through radical innovation in new materials and additive manufacturing, GA n. 101046835, CUP D43B21000060006). The partners of the ThermoDust project are: Trinity College of Dublin - IRE, University of Barcelona - ES, University of Twente - NL, Jozef Stefan Institute - SI.</p> <p>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.</p>
<b>Composition of the research group</b>	1 Full Professors 1 Associated Professors 1 Assistant Professors 4 PhD Students
<b>Name of the research directors</b>	Dr. Sara Bagherifard, Prof. Mario Guagliano

<b>Contacts</b>
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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

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>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).</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>