



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 3 - Engineering Design and Manufacturing for the Industry of the Future

**THEMATIC Research Field: SOLID STATE METAL POWDER DEPOSITION FOR NEW
ADDITIVE DESIGN SOLUTIONS**

Monthly net income of PhDscholarship (max 36 months)
€ 1325.0
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	Solid state deposition of metal powder by exploiting high energy impacts is becoming more and more used 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 as an additive process for free standing 3D parts (high deposition rate, no need of protected atmosphere, high flexibility in mixing powder of different materials,..). However, the full exploitation of cold spray in AM requires the digitalization of the process. Aim of this research is the definition of a digital approach to manage the cold spray deposition in terms of: 1. defining the deposition strategy with respect of the desired geometry 2. assessment of the expected properties of the deposited parts 3. optimization of the process by means of an AI approach 4. development of a meaningful case study.
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 load conditions of interest as well as experimental cold spray deposition, by considering the different parameter combinations and the definition of the correct tool path according to the numerical simulation results. Finally, an accurate mechanical characterization of the deposited materials will be performed to find the



	most performant processes in terms of mechanical properties.
Educational objectives	The aim of the position is to educate an expert in cold spray metal powder deposition for additive manufacturing, able to manage research, development 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 Artificial Intelligence and in the numerical and experimental techniques requested for a correct and competitive application of these techniques.
Job opportunities	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 4 PhD Students
Name of the research directors	Prof. Mario Guagliano, Dr. Sara Bagherifard

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	662.5 €
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 5401, 42.

An increase in the scholarship will be applied for periods up to 6 months (approx. 660 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.