POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

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 is a technology based on the use of kinetic energy to induce bonding of metal powders on substrates. The process involves accelerating the powders to supersonic speeds at which adhesion to the substrate is possible. Cold spray is an attractive technique for the creation of 3D products, as it allows us to overcome the main limitations of current additive technologies. However, shape control in this technology is still a significant challenge. The research is based on using a customized composite powder made of 2D materials mixed with metallic powders of high conductivity. The project is aimed at the development of new deposition strategies of these bespoke powders to obtain structures with extraordinary thermal properties to be used for thermal management. The research includes the definition of deposition parameters for these complex materials, full microstructural, physical and mechanical characterization and designing possible optimal post-treatments.
Methods and techniques that will be developed and used to carry out the research	The research activity involves the development of experimental procedure for the deposition of tailored powders for the creation of 3D products and coatings. As part of this activity, the optimal strategies and parameters of the AM processes mainly including cold spray deposition will be defined thanks to numerical simulations and experimental activities. In the second step, the obtained structures will be fully characterized by determining their mechanical and physical properties.

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Educational objectives	The educational aim of this project is to train an expert in solid state additive manufacturing technology, its development and characterization, with soft and hard skills able to direct research, development and innovation. The candidate will also gain knowledge and skills in coating and additive manufacturing sector in general and in the numerical and experimental analysis techniques requested for the correct and competitive design, application and characterization of various deposition techniques and surface treatments.
Job opportunities	Strong collaboration is envisioned with: Trinity College of Dublin (IE), University of Barcelona (ES), University of Twente (NL). 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 3 Assistant Professors 5 PhD Students
Name of the research directors	Proff. Mario Guagliano, 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	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.