



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: DEVELOPMENT OF A NEW PROCESS FOR SOLID STATE
METAL POWDER DEPOSITION**

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

Modern manufacturing is shifting towards additive processes for innovative design, sustainability, and reduced material use. However, mass production faces obstacles due to low production rates and environmental constraints in thermal processes. In contrast, cold spray, a solid-state additive manufacturing method, offers material versatility but struggles with complex shapes. The present research is aimed at exploring and developing the basis for a new solid-state deposition of metal powder able to remove the present AM limitations and pave the path to a new process with superior production rates, properties and functional solutions. The proposed method considers charging and accelerating the powder through high-voltage modulated electrostatic fields.

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

The physical basis of the proposed process has been already confirmed. Starting from this point, numerical Multiphysics simulations of the process as well as FEM analysis of the impact of the powder against the target will be developed to determine the tuning of the main process parameters. Then, the design of a first prototype able to accelerate the powder at the desired velocity will be designed and constructed. The experiments by means of this device and the characterization of the deposited layers will allow to highlight how to further proceed in view of a possible industrial application of the process.

Educational objectives



	The aim of the position is to educate an expert in the design of complex electromechanical systems for metal powder solid state deposition for additive manufacturing, able to manage research, design, 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	A recent survey showed that PhD candidates are 100% employed after one year, in national and international companies and academic and non-academic research institutions, engaged in innovation, research and technical development. On average the survey showed that people earning our PhD title obtain a 35% higher salary than the corresponding employers with a Master of Science degree.
Composition of the research group	1 Full Professors 1 Associated Professors 2 Assistant Professors 7 PhD Students
Name of the research directors	Proff. Mario Guagliano, Sara Bagherifard

Contacts	
<p>Prof. Mario Guagliano <i>Phone</i> +39 02 2399 8206 <i>E-mail</i> mario.guagliano@polimi.it</p> <p>Prof. Sara Bagherifard <i>Phone</i> +39 02 2399 8252 <i>E-mail</i> sara.bagherifard@polimi.it</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



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.