POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

THEMATIC Research Field: LASER MICROMACHINING FOR CLEAN ENERGY TECHNOLOGIES

Monthly net income of PhDscholarship (max 36 months)
1500.0 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	The increase in energy demand in the world requires rapid development of energy conversion and storage technologies. Digital manufacturing processes are key enablers from this perspective. Laser-based manufacturing tools can be adapted for subtractive, additive, and joining processes. Hence, their use in clean energy technologies from fuel cells to electric motors can provide several advantages compared to the conventional counterparts in terms of adaptability, flexibility, and ease of process diagnostics and monitoring. Pulsed laser sources can be manipulated in space and time to achieve different material transport phenomenon that can be exploited for advanced properties of clean technology products. The advent of high-power ultrafast laser sources will allow to engineer products with tailored properties by manipulating the light-matter interaction in wide areas with high productivity. This PhD project will focus on laser micromachining with pulsed laser sources for enhancing the properties of clean energy technologies such as fuel cells, storage, and motion devices. The project will work on large area surface structuring, texturing, cleaning, cutting, and welding operations employing industrial laser systems on a variety of materials ranging from metals to polymers to

	ceramics. The candidate will explore beam shaping technologies such as beam sharing optics and burst mode for balancing the correct energy deployment strategy in time and space. The work will combine modelling and experimental approaches to develop laser-based micromachining solutions.
Methods and techniques that will be developed and used to carry out the research	1. Implementation of a flexible laser micromachining platform for clean energy materials. 2. Developing multi-scale modelling solutions for laser-material interaction from single pulse to large area processing. 3. Process development and investigation of the industrial scalability with the data gathered.
Educational objectives	We provide doctoral candidates with high-level scientific training, fostering and refining research and problem solving abilities by focusing on both theoretical and experimental skills. A PhD in Mechanical Engineering will be able to layout, draft and carry on original research, by leading a research group or working in a team.
Job opportunities	Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared Master of Science holders in the same field. List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research: -TU Munich -University of Stuttgart -IMA Group
Composition of the research group	2 Full Professors 1 Associated Professors 1 Assistant Professors 5 PhD Students
Name of the research directors	Prof. Ali Gökhan Demir

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Contacts
Research director: aligokhan.demir@polimi.it ph: 0223998590 https://www.mecc.polimi.it/ricerca/sezioni/tecnologie-meccaniche-e-produzione/ For questions about scholarship/support: phd-dmec@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
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, fundingfor participation in courses, summer schools, workshops and conferences) for a total amount of € 6.114,50. 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. 750 euro/month- net amount). Teaching assistantship: availability of funding in recognition of supporting teaching activitiesby 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.