POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 37th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

PON - GREEN Research Field: GREEN AND RECYCLED POLYMER COMPOSITES: MECHANICAL PERFORMANCE ASSESSMENT,TO EXTEND THEIR INDUSTRIAL APPLICATIONS

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	The increasing demand for sustainable products with reduced environmental impact is outlining new perspectives for the use of green and innovative materials in various industrial sectors.Polymer based, fiber reinforced engineering materials are considered as good candidates for the metal replacement in many industrial sectors, for the achievement of lightweight structures, conceived for the reduction of energy consumption and CO2 emissions and at the same time fully compliant with the structural and dynamical requirements. However, recyclability of these materials may become a limiting factor for a more widespread use of these materials. Moreover, recycling of polymer based, engineering materials, represents an important part of the wide UE action plan on circular economy and is specifically mentioned in the mission M2C1 of the Italian PNRR. The challenge of this PhD project is that of investigating the potential of new advanced green materials (e.g. manufactured using recycled raw materials, or biopolymers obtained from renewable source materials, or reinforced with natural fibres) for producing sustainable components with high mechanical performance. This will involve the integration of experimental techniques and modelling approaches at different levels, to provide

	comprehensive knowledge of the physical phenomena and to support the development of effective solutions in a wide range of applications.
Methods and techniques that will be developed and used to carry out the research	The research activity will focus on the assessment of the mechanical performance of green and recycled polymer composite engineering materials and components. Static strength, fatigue strength and dynamic behaviour will be studied.By a mix of experimental and analytical approaches, the impact of the use of green materials on the desired mechanical properties will be studied, e.g. by considering different mixing ratios of virgin and recycled materials, different sources of recycled materials (post-industrial or post-consumer), etc. The relationship between the microstructure of the material and the mechanical performance will be studied.The PhD candidate will be asked to provide his/her personal and original contribution to the research topic, by developing and integrating modelling approaches at different levels (from micromechanical modelling of composite materials to structural and dynamic analysis).
Educational objectives	The Doctor in Mechanical Engineering will be able to define, start and carry out original research by working in a team or leading a research group. Both theoretical and experimental skills are mastered.
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.The skills and knowledge acquired during this PhD will allow to cover positions in the R&D divisions of suppliers of polymer-based materials, suppliers of components in different industrial sectors, principally the automotive industry, and in general in companies involved in the technical aspects of the circular economy of polymer-based materials. This research activity will be conducted in cooperation with RadiciGroup High Performance Polymers - Radici Novacips SpA (minimum 6, maximum 12 months internship). The company is one of the most highly regarded multinational manufacturers and suppliers of polyamide and polyester engineering

	polymers. The company will supply materials and specimens for testing purposes and will be actively involved in the definition of the research programme, offering their expertise on recycled and bio- polymers and their applications.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 4 PhD Students
Name of the research directors	Prof. Andrea Bernasconi

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	566.36 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Radici Novacips S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
Funding for educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences); funding per PhD student per year: 2nd year: euros 1.534 3rd year: euros 1.534. Teaching assistantship: availability of funding in recognition of support to teaching activities by the PhD student; 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. **Computer availability:** 1st year: individual use 2nd year: individual use 3rd

year: individual use. **Desk availability:** 1st year: individual use 2nd year: individual use 3rd year: individual use