



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

PNRR_352 Research Field: DEVELOPMENT OF MATERIALS FOR FIRST WALL COATINGS IN FUSION REACTORS

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	
<p>Motivation and objectives of the research in this field</p>	<p>The study of plasma-material interactions is a central issue for the development of future fusion reactors. Materials must resist the harsh fusion environment; surface degradation must be contained to avoid polluting the core plasma with impurities from the walls of the fusion chamber. Through an experimental approach the PhD project focuses on three aspects:</p> <ul style="list-style-type: none"> (i) deposition and characterization of W-based films and coatings tailored at the nanoscale; (ii) investigation of the nanoscale morphological evolution of plasma-exposed surfaces made of selected materials of specific interest for fusion machines (in particular tungsten, identified as first wall material in tokamaks such as DTT or SPARC); (iii) investigation of the behaviour of the deposited coatings in the harsh environment of the tokamak (e.g. high heat fluxes, exposure to liquid metals). <p>The study is supported by Eni S.p.A. in the framework of the PNRR recovery plan, in line with Mission 2: "Green revolution and ecological transition" (M2C2) and Mission 4: "From research to enterprise" (M4C2), this last aiming at the introduction of PhD tracks for innovation in enterprises through the development of high-profile competencies. In this regard an internship with a minimum period of 6 months is foreseen. In addition, the main topic</p>



	of the presented research program is the development of advanced materials one of the Key Enabling Technologies (KET) identified by the EU commission in the framework of the Horizon EUROPE project.
Methods and techniques that will be developed and used to carry out the research	The foreseen research on coatings will be focused on the PVD family, more specifically Pulsed Laser Deposition and High Power Impulse Magnetron Sputtering. In addition to the deposition techniques different characterization such as SEM, XRD, EDXS will be used. The study of surface morphology will make use of uncoated and coated tungsten samples, exposed to plasmas in the linear machine GyM as well as in tokamaks and in liquid metals environments.
Educational objectives	Education of people to be launched in the world of research and high technology industry in the fields of physics and engineering of materials, able to manage interdisciplinary issues, perform and interpret complex experiments and produce new equipment.
Job opportunities	Private and public R&D. Highly qualified positions in a wide range of industries related with production, development, and use of advanced materials. The present research will be performed in collaboration with national and international partners. In addition to ENI SpA we can mention EUROfusion Consortium and ENEA.
Composition of the research group	3 Full Professors 4 Associated Professors 2 Assistant Professors 16 PhD Students
Name of the research directors	Prof. Matteo Passoni, Dr. David Dellesega

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

National Operational Program for Research and Innovation

Company where the candidate will attend the stage (name and brief description)	ENI 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

Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations, and computer, etc. The amount is about Euro 5700.

Teaching assistantship: Availability of funding in recognition of supporting 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: individual use.

Desk availability: individual use.

Accommodation in Politecnico's Residences (<http://www.residenze.polimi.it>) is available for PhD candidates: special rates will be applied to selected out-of-town candidates (Detailed info in the call for application).

Research period abroad: Our candidates are strongly encouraged (6 months minimum is mandatory) 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).