MATERIALS SCIENCE AND TECHNOLOGY	
CYCLE	**XL**
COORDINATOR	Prof. Mauro RICCO' email: mauro.ricco@unipr.it Department of Mathematical, Physical and Computer Sciences
DURATION	3 years
STARTING DATE OF THE PHD PROGRAM	01/11/2024
PARTNER INSTITUTION	• The Italian National Research Council (C.N.R.)
POSITIONS PUT OUT TO COMPETITION	**13**
ADMISSION PROCEDURES	Assessment of QUALIFICATIONS Oral Exam in PRESENCE ore REMOTELY
ADMISSION REQUIREMENTS	Regardless of age and citizenship, applicants holding at least one of the following academic qualifications can apply for admission: – Laurea specialistica or Laurea magistrale (second cycle master's degree) – Laurea Vecchio Ordinamento (degree obtained under the previous Italian regulations); – Second cycle Master's degree obtained abroad, equivalent to the above mentioned Italian degrees and recognized as suitable for the admission to doctoral program Undergraduates can also apply for admission to the selection, with the obligation to obtain the degree **by 31.10.2024**

TRAINING OBJECTIVES

The Ph.D. in "Materials Science and Technology" aims to provide graduates in: Materials Science, Physics, Chemistry, Industrial Chemistry, Biological Sciences, Biotechnology and Engineering with the necessary skills to carry out research activities of high scientific and professional qualification in the field of Materials Science and Technology at Universities, Research Centers or private entities. The course offers a strong, interdisciplinary preparation with specific courses, as well as with research activities conducted also abroad within scientific collaborations.

RESEARCH AREAS

- Materials for sensors and bioelectronics
- Materials for electrochemical storage (batteries and supercapacitors)
- Nanodiagnostic techniques
- Auxetic polymers
- Supramolecular sensors and devices
- Carbon nanostructures
- Low-dimensional semiconductor structures
- Self-repairing and self-diagnostic polymers
- Ceramic and composite materials
- Vitrimers
- Materials for bionanotechnology and nanomedicine
- Photocatalytic solid foams
- Semiconductor materials for applications in power electronics and UVC radiation detection
- Porous materials for chemical separation
- Molecular and nanostructured materials for energy, health and environment
- Multifunctional magnetic thin films and nanostructures
- Magnetic materials for energy transition (permanent magnets, shape memory magnetic materials, magnetocaloric materials)
- Composite hydrogels for 3D printing of biomatrices for tissue engineering (BIO X 3D printer - CNR-ISSMC ; Bio-Hybrid Composites for Regenerative Medicine - CNR-ISSMC)

Position with Scholarship		
N°	***Funding entity***	***Research Topic, if any***
3	Scholarship funded by University of Parma (Ministerial funds)	
1	Scholarship funded by The Italian National Research Council C.N.R. - IMEM	The aim of the thesis is the development and study of innovative hard magnetic materials to develop new Green magnets with a reduced content of critical materials such as Rare Earth or Cobalt. In particular, we will study new types of ferrites, metal-ferrite nanocomposites and multi-element alloys based in the concept of "high entropy alloys". The thesis will be developed within the activities of the European project Horizon Europe "Beethoven".
1	Scholarship funded by The Italian National Research Council C.N.R. - ISSMC	Biomaterials in the form of injectable hydrogels that can be processed by means of 3D printing will be designed and developed to obtain nano-composite and multifunctional biomimetic porous matrices of bone and cartilage tissue for tissue engineering applications. The design of bioinspired materials will be linked to the development of customized medical devices for the regeneration of tissues, organs and deep wounds and being able to integrate cells, biomolecules, and drugs to deliver advanced therapies. In addition, the opportunity to design biomatrices will enable the engineering of 3D cellular models to investigate the properties of systems of different complexity and biological activity and for the drug-testing of new pharmacological therapies
1	Scholarship co-funded by Fondazione Cariparma	
Position with Scholarship LINKED TO SPECIFIC TOPICS (art. 6 of the Competition notice) *** Modified with Rector Decree n. 1556 of 02.07.2024**		
N°	***Funding entity***	***BOUND RESEARCH TOPIC***
1	Scholarship partly financed with UNIVERSITY funds and co-financed by the Department of Chemistry, Life Sciences and Environmental Sustainability (funds Project PNRR-M4C2- I1.1 - PRIN 2022 - Settore PE5 - Titolo Progetto: ALICE - light-Activated high-performance actuators by electrospinning of reversibly crosslinked LIquid CrystallinE networks - Codice Progetto 20224EBZ3Y - Codice CUP D53D23010120006)	Molecular receptors for the enrichment of modified peptides for ultra-sensitive proteomics
1	Scholarship partly financed with UNIVERSITY funds and co-financed by the Department of Chemistry, Life Sciences and Environmental Sustainability (funds PNRR "National Center for Gene Therapy and Drugs based on RNA Technology", codice identificativo MUR CN00000041 – CUP [E63C22000940007] del bando a cascata del Progetto "MUltifunctional synthetic platforms for the precision delivery of NUcleic AcidS"- MUNUS, codice CUP D53C23003990007)	Self-assembled materials for cell transfection and nanomedicine

1	Scholarship partly financed with UNIVERSITY funds and co-financed by The Italian National Research Council C.N.R. - IMEM	Materials and devices for flexible organic electrochemical sensing for biological fluid monitoring applications, aimed at wearable and highly integrated devices
1	Scholaship funded by EMILIA ROMAGNA REGION CUP D92J24000010002	Germanium oxide: a new ultrawide bandgap ambipolar semiconductor for power electronics. We aim to deposit (e.g., MOVPE) and characterize (e.g., XRD, Raman, van der Pauw-Hall) epitaxial thin films of germanium oxide in the rutile phase r-GeO2. For this purpose, different single crystalline substrates will be employed. The possibility to experimentally obtain and control n- as well as p-type conductivity in r-GeO2 will be investigated through the employment of proper extrinsic dopants during growth .
1	Scholarship co-financed with funds under the PNRR - Mission 4 component 2 (**Ministerial Decree 630/2024)** and co-financed by the Company A.L.S.I.A. Agenzia Lucana di Sviluppo e di Innovazione in Agricoltura CUP D92J24000290004	Implementation of a "bioristor", a new sensor developed by CNR-IMEM, in the ALSIA station for plant phenotyping
1	Scholarship co-financed with funds under the PNRR - Mission 4 component 2 (**Ministerial Decree 630/2024)** and co-financed by the Company NanoPhoenix S.r.l. CUP D92J24000290004	Fabrication and development of nanostructured sensor platforms, to be implemented in miniaturized lab-on-chip systems for molecular diagnostics based on DNA nanotechnologies.
1	Scholarship co-financed with funds under the PNRR - Mission 4 component 2 (**Ministerial Decree 630/2024)** and co-financed by the Company Versalis S.p.A. CUP D92J24000290004	Study of vitrimeric EPDM elastomers, aiming at producing reprocessable and recyclable polyolefin-based elastomers produced by Versalis (ENI group). Specifically, the PhD scholarship concerns the study of new reversible cross-linking agents using dynamic covalent bonds and multiple hydrogen bonds.

ADMISSION PROCEDURES

Assessment of QUALIFICATIONS: up to 60 points
(a minimum score of 30 points shall be required to be admitted to the Oral Exam)
ORAL EXAM: up to 60 points
Minimum score for ELIGIBILITY: 70/120

ORAL EXAM PROGRAM

THE ORAL EXAM TAKES IN THE PRESENCE and with the possibility of carrying out the interview **REMOTELY** for candidates residing abroad or temporarily abroad for study / work reasons. To this end, candidates must submit **a motivated REQUEST** as per the model attached to the competition announcement)

The ORAL EXAM will focus on the candidate's motivation to attend the PhD, on the description of his specific research interests and on a discussion of the qualifications presented by the candidate.

Foreign Language the fluency of which shall be assessed during the Oral Exam	**ENGLISH**	The evaluation of the knowledge of this language will be oral and will consist in translating of a scientific text.

SCHEDULE OF THE ADMISSION EXAMS			
ASSESSMENT OF QUALIFICATIONS		It is the candidate's responsibility to verify the outcome of the evaluation of qualifications, which can be consulted in their reserved area by connecting to the page http://unipr.esse3.cineca.it/Home.do in the days preceding the date of the Oral Exam	
ORAL EXAM	**DATE**	2nd September 2024 (with possible extension in the following days)	
	TIME	09:00 am (Italian Time)	
	PLACE	Department of Mathematical, Physical and Computer Sciences PHYSICS BUILDING Parco Area delle Scienze, 7/A – Campus 43124 PARMA - ITALY	
FURTHER INFORMATION		**The choice of the Research Topic to be expressed in Annex A is not binding on the assignment of the research project, and it is intended to assess candidates skills during the admission exam.** The PhD research topic will be assigned by the Academic Board.	
		THE INTERVIEW MAY BE HELD ALSO IN ENGLISH	For foreign candidates it is possible to carry out the admission examination exclusively in English. For Italian candidates it will be possible to take the admission examination in Italian or in English at the candidate's choice

LIST OF QUALIFICATIONS TO BE SUBMITTED AND THEIR ASSESSMENT	
MANDATORY DOCUMENTS TO BE ATTACHED TO THE ON-LINE APPLICATION	
ANNEX A	(art. 3.2 of the Competition notice)
Identification Document	Scanned Copy of a valid identity document with photo (i.e. identity card, passport)
Curriculum Vitae et studiorum	No specific CV format is required (see art. 3.2 of the Competition notice)
Abstract of degree thesis	Abstract of the second cycle master's degree thesis. Undergraduate applicants must submit the draft of the thesis approved by their supervisor (abstract/draft of the thesis: 10.000 characters including spaces)
Academic Qualifications	**Certificates and academic transcript of records for both Bachelor' and Master' degrees** containing the following details for each degree held: (art. 3.2 of the Competition notice): University that granted the degree - Type of degree (first cycle/second cycle/single cycle) Name of the degree program - Date of graduation - Final mark - List of exams and corresponding scores (academic transcript of records) - Translation into Italian or English (only for degrees issued in languages other than Italian or English).
LIST OF EVALUABLE QUALIFICATIONS (only qualifications attested by a document drawn up in Italian or in English)	

Curriculum Vitae et studiorum	Including academic career and postgraduate experience, accompanied by a statutory declaration in lieu of the certification of the exams passed with the relevant marks, as well as the final graduation mark.	**Up to 20 points**
Graduation mark	Score related to the final mark: - 110 with honors (magna cum laude): 20 points - 110: 16 points - From 105 to 109: 12 points - From 100 to 104: 8 points - From 95 to 99: 4 points - Under 95: 0 points	**Up to 20 points**
Average of the exam marks (if the candidate will attain the degree no later than 31 October 2024)	Score related to the average of the exam marks: - 30/30: 20 points - From 28/30 to 29/30: 16 points - From 26/30 to 27/30: 12 points - 25/30: 8 points - 24/30: 4 points - Under 24/30: 0 points	**Up to 20 points**
Graduation thesis	Consistency of the Master's Degree thesis with the doctoral program research topics (briefly describe the topics in the curriculum vitae)	**Up to 10 points**
Statement of Research Interest	Short text – maximum 2 pages – in Italian or in English, aimed at explaining the candidate's reasons to attend the PhD program and at describing her/his specific research interests	**Up to 5 points**
Scientific Publications	Articles and/or reviews in scientific journals with peer reviewing, abstracts of papers or posters presented at conventions or meetings	**Up to 5 points**

EVALUATION ORAL EXAM		
Interview Program	**Evaluation CRITERIA**	**POINTS**
The ORAL EXAM includes the presentation of the research project and is intend to assess the suitability of the applicant to pursue scientific research as well as the general knowledge of issues connected to the PhD course	○ knowledge of foreign languages: 10 points ○ general knowledge of issue connected to the Master's thesis: 25 points ○ general knowledge of issues connected to the PhD course: 25 points	**Up to 60 points**