POLITECNICO DI MILANO

PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 39th cycle

Number of scholarship offered	3
Department	DIPARTIMENTO DI CHIMICA, MATERIALI E INGEGNERIA CHIMICA "GIULIO NATTA"

Description of the PhD Programme

The specific research activity sharing this broad research area might be focused on one of the following topics: **Micro and nanostructured materials:** Production of innovative nanostructured thin films and surfaces, and their physical characterization (e.g. morphology, structure and electronic properties). Focus will be on the study of materials for energy-related applications, with a condensed matter physics approach (e.g. materials for thermoelectric, photovoltaic and catalytic applications). **Functional organic materials for applications in photonic and electronic**. The research will deal with the synthesis and characterization of organic functional materials with tailored optical and electrical properties.**Surface engineering and advanced coatings:** Surface treatments play an important role in several fields: energy, environment, design, architecture, electronics, biomaterials, etc.. The activity will be focused on the production of innovative coatings and thin films by electrolytic or PDV/CVD techniques. The approach combines electrochemistry, surface engineering, physical chemistry and metallurgical competences.**Mechanical and physical properties of micro and nano-structured materials for biomedical applications:** The objective is to improve the knowledge on the relationship between properties and structure of micro and nano-structured biomaterials, such as ceramic based nano-structured coating.**Polymeric Materials for Advanced Applications:** The activity is aimed at developing and/or improving materials and products for new applications through macromolecular structure design, new polymer production routes and appropriate bulk and surface physico-mechanical characterization in the following areas: Polymer Nanocomposites; Advanced rubbers; Composites for aeronautic and marine applications; Innovative textiles; Materials for energy; Polymeric Lab on Chip Devices; Materials and technologies for environment**Scattering, Spectroscopy, Modelling and theoretical approaches to the structure of materials**: Development of structural models, from sub-nanometric to micrometric scales, allowing to rationalize the behaviour of new functional and nanostructured materials. Fields of application : Polymer Nanocomposites; Advanced rubbers; Innovative textiles; Materials for electronic, photonic and energy; Biomaterials**Production and characterisation of titanium oxides:** The alterations caused by anodising treatments of titanium oxide will be exploited to functionalize titanium surfaces. Applications range from photocatalytic systems for wastewater treatment and air purification, to the implementation of a new generation of photovoltaic cells, to the biomedical field.**Innovative**

materials for civil and industrial engineering works: The main objectives are: - development and characterization of novel low-friction materials with high wear resistance and strength; - prediction of mechanical properties of composite materials depending on aging and fatigue loading conditions; - reinforcement of steel and concrete structures by composite materials (FRP).**Materials and techniques in the Cultural Heritage**

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OPEN SUBJECT Research Field: MATERIALS ENGINEERING

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	1. Polymeric Materials for Advanced Applications; 2. Surface engineering and advanced coatings; 3. Functional organic materials for applications in photonic and electronic; 4. Production and characterization of micro and nano-structured materials for catalysis, photovoltaic, electronic, biomedical applications; 5. Innovative materials for civil and industrial engineering works; 6. Scattering, Spectroscopy and modeling of materials; 7. Materials and techniques in the Cultural Heritage
Methods and techniques that will be developed and used to carry out the research	Advanced methods for materials preparation and characterization, ranging from mechanical tests, physical properties determination, chemical and structural analysis, will be learned and used. Quantum Chemical modelling of molecular materials and polymers
Educational objectives	The objective is to combine the theoretical knowledge with technological skills in order to train a qualified researcher who can guide the design, manufacturing and use of traditional and/or new materials.
Job opportunities	PhD course offer specialized curricula aimed to the formation of specialized people with skills in: i) development and innovation in the production, processing, application and conservation of traditional materials; ii) development of innovative materials for the production of new manufactured goods or devices to cope with the growing demands of modern technologies.

Composition of the research group	15 Full Professors 10 Associated Professors 20 Assistant Professors 30 PhD Students
Name of the research directors	Chiara Bertarelli

Contacts
chiara.bertarelli@polimi.it +39 022399.3224 http://www.dottorato.polimi.it/corsi-di-dottorato/corsi-di-dottorato-attivi/ingegneria-dei-materiali/

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

Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences) financial aid per PhD student:

1st year: 1900 euro
2nd year: 1900 euro
3rd year: 1900 euro

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 and desk availability