POLITECNICO DI MILANO

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

THEMATIC Research Field: HIGH-PERFORMANCE PHOTOPOLYMERS FOR HOLOGRAPHIC OPTICAL ELEMENTS

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	Holographic Optical Elements (HOEs) are becoming widespread devices in different technological fields, such as automotive (lighting systems), augmented reality (smart goggles, displays), astronomical and spectroscopic instrumentation (dispersing elements). The key element of such devices is the photosensitive material that “host” the holographic pattern. Among the existing materials, photopolymers are the most interesting and promising ones, thanks to their high light sensitivity, the self-developing feature (they don’t need a wet chemical treatment to obtain the hologram after the light exposure) and the possibility to tailor the chemical composition to achieve the target performances. This PhD project aims at developing innovative photopolymers with enhanced performances in order to design and manufacture efficient HOEs to be used in the field of astronomical instrumentation.
Methods and techniques that will be developed and used to carry out the research	The approach consists in the optimization of the writing chemistry, through the design of new monomers with high refractive index and the selection of appropriate binders. Such components will be characterized and combined in the final holographic photosensitive material. Different strategies for transferring the pattern, such as direct laser writing and holographic exposure, will be employed and optimized in order to have a high fidelity reproduction of the holographic pattern. The devices will be finally tested in instrumentation.

	in instrumentation.
Educational objectives	This PhD project aims at develop innovative materials in a multidisciplinary context. The objective is to acquire specific expertise in the field of holographic materials through a combination of chemical, physical, engineering skills. Another object is to develop a common language between the stakeholders involved in the project with different backgrounds.
Job opportunities	The field of photopolymers and holographic materials is in large expansion and holographic devices are becoming more and more important in many markets, such as automotive and augmented reality devices. Different companies work on the development of both the materials and the devices. There are therefore many professional opportunities for a qualified job and the outlook is positive.
Composition of the research group	0 Full Professors 1 Associated Professors 7 Assistant Professors 2 PhD Students
Name of the research directors	Andrea Bianco

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

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The student will have the possibility to use the housing available at the INAF-Astronomical Observatory of Brera, Via Bianchi 46, 23807, Merate, Italy

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other informations
The student will work in a multidisciplinary context with the possibility to interact with other engineers and scientist mainly in the field of astronomical instrumentation; a shared office will be provide and a computer too.

Confidentiality (Agreement with company): since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the funding company. Upon acceptance of the scholarship, the beneficiary must sign a specific commitment.

Individual budget for research (5.700 euro):1st year: 1.900 euro; 2nd year: 1.900 euro; 3rd year: 1.900 euro

Teaching assistantship (availability of funding in recognition of supporting teaching activities by the PhD student): there are various forms of financial 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 regulation.