Novel light-emitting nanomaterials for optoelectronics

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About the Project

Colloidal semiconductor nanocrystals are nowadays employed in consumer electronics products such as displays and lighting. Yet, semiconductor nanocrystals can be exploited in quantum technologies as single-photon emitters but much effort is still required to improve their performance before this class of nanomaterials can compete with other single-photon generation venues. Importantly, single-photon emission is at the very base of quantum technologies as computing and secure communication.
The research activity aims at developing synthetic routes to obtain luminescent semiconductor colloidal nanocrystals, exploit such materials in light-emitting diodes (LEDs) and single-photon emitting devices and, identify which synthetic and structural parameters promote device performance. Post-synthetic chemical treatments of colloidal nanocrystals can promote enhanced performance in devices while detailed studies of the physicochemical properties of nanocrystals are required to identify which composition, structure and shape are best to fabricate light-sources with innovative architectures.
As discussed above, the interest in developing and study novel semiconductor nanocrystals is twofold: improve the performance of LEDs based on this class of nanomaterials and, development of non-classical light sources. Therefore, the research activity is expected to have an impact on both established and developing technologies.
The PhD candidate will carry out synthesis of metal chalcogenides and halide perovskites nanocrystals, study of chemical processing to enhance their emission or stability and, carry out detailed photo-physical characterization both at the single-nanocrystal level and as ensembles. The studied nanomaterials will then be exploited for the fabrication of both classical and non-classical electrically driven light-sources.
Funding for this position is provided by the European Research Council trough the 2019 Starting Grant "NANOLED". The project aims at developing light-emitting diodes based on individual colloidal NCs, thus paving the way to novel electrically driven single-photon sources with small footprint that are embeddable in photonic quantum networks.

Requirements: The ideal candidate must have a master's degree in one of the following areas: Materials Science, Chemistry, Chemical Engineering or Physics. The candidate must be interested in a very interdisciplinary research activity encompassing chemistry, engineering and physics.

For further details concerning the research theme, please contact: Francesco.distasio@iit.it
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