NanoLab Talk

Politecnico di Milano, Department of Energy, Cesnef (Building 19), via Ponzio 34/3, Milan
Seminar Room 1° floor

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Doped semiconductor nanocrystals as plasmonic materials for photonics and hot electron extraction

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Doped semiconductor nanocrystals have a high carrier density (about 10^{21} cm^{-3}), resulting in strong plasmonic resonances in the infrared. The plasmonic response can be modulated via the employment of external stimuli, such as the electric field and light pulses [1]. We fabricated one-dimensional multilayer photonic crystals alternating indium tin oxide (ITO) and silicon dioxide. With UV light pulses we demonstrated ultrafast photodoping of ITO and, consequently, the modulation of the optical response of the photonic crystal [2].

Moreover, we aim at studying infrared solar devices based on hot electron extraction by employing doped semiconductor nanocrystals. After photoexcitation energetic electrons are generated in the Fermi gas. At the very initial stage after excitation hot electrons are created. In a heterojunction with a semiconductor, if the electrons reach the interface with the semiconductor and are above the bottom of the conduction band, they are transferred to the semiconductor contributing to a current towards the electrodes [3]. I will present the first preliminary results towards the achievement of photocurrent in these systems and the last results reported in literature.

References

[1] I. Kriegel, F. Scotognella, and L. Manna, Physics Reports **674**, 1 (2017).
[2] G. M. Paternò, C. Iseppon, A. D'Altri, C. Fasanotti, G. Merati, M. Randi, A. Desii, E. A. A. Pogna, D. Viola, G. Cerullo, F. Scotognella, and I. Kriegel, Sci Rep **8**, 1 (2018).
[3] P. Christopher and M. Moskovits, Annual Review of Physical Chemistry **68**, 379 (2017).

About the speaker:

Francesco Scotognella is associate professor at Politecnico di Milano. He has been visiting scientist at University of Toronto, Nanyang Technological University and Berkeley Labs. He studies the photophysics of nanostructures and the optical properties of photonic structures. Since April 2019, he is ERC CoG grantee (http://www.paideia-h2020.eu/) studying the plasmon induced hot electron extraction with doped semiconductors.

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