Friday Materials Science Colloquia

Friday, October 28th 2022, 12 p.m.
Seminar room, U5 Building – via Roberto Cozzi 55, Milano

Lecturer: **Francesco Carulli**

Title: **From luminescence solar concentrators to plastic scintillators: challenges and strategies to realize functional plastic waveguides**

Abstract: The realization of high quality optical and electro-optical devices obtained through the insertion of optically-active nanomaterials inside polymeric matrices has allowed to combine the easy tunability of the optical properties and the robustness of the former with the possibility of obtaining light devices with an arbitrary shape of the latter. The application of this approach leaded to very promising results in luminescent solar concentrators (LSCs), a device consisting in slab doped or coated with chromophore capable of absorbing a fraction of incident light and re-emitting photons which are then focused on the device edges via total internal reflection. The integration of nanomaterials as chromophore in LSC enabled to realize large dimension devices which overcome the intrinsic limitations of previous generations and paved the way for new highly efficient technologies [1]. Recently, the know-how regarding photon-management and optical tunability [2] combined with surface engineering strategy of nanomaterials developed in LSCs technology, was also successfully applied in scintillating nanocomposites [3-4], yielding to the realization of scintillating composite materials with performances surpassing pure crystal- and plastic- based analogue technologies.

References:
[1] F. Meinardi et al., Nature Nanotech 10, 878–885 (2015)
[2] L. Dhamo et al., Adv. Optical Mater., 9, 2100587 (2021)
[3] M. Gandini, Villa et al., Nat. Nanotechnol. 15, 462–468 (2020).
[4] F. Carulli, et al. Adv. Optical Mater., 10, 2200419 (2022).

Lecturer: **Chiara Ferrara**

Title: **MXene compounds as anode for sodium-ion batteries: structure, defects, electrochemical behavior**

Abstract: MXenes are a new class of layered materials characterize by some unique structural and functional features, making them appealing for the use as electrodes in energy storage devices such as rechargeable batteries and supercapacitors [1]. Electrochemical performance of MXenes have been widely investigated in the recent years, but, at the same time, their structure is still not completely resolved [1,2]. Aim of this project was the investigation of the structure of the Ti 3 C 2 T x with T = F, O, OH, the most common MXene composition and the one showing the best performance when tested as electrode in sodium ion batteries. Due to the complexity of the system, the combination of different techniques (neutron diffraction, XAS, XPS) was necessary to combine different information and, also considering the precursor compound (the MAX phase Ti 3 AlC 2) it was finally possible to build a structural model fitting the experimental data and to correlate peculiar structural features with the observed electrochemical behavior [3].

References:

[1] C. Ferrara et al., Current Opinion in Electrochemistry, 29 (2021) 100764
[2] A. Gentile et al., Small Methods 4 (2020) 2000314
[3] C. Ferrara et al., Nano Letters, 21 (2021) 8290-8297