8 gennaio - “Hybrid Perovskite Solar Cells: a Game Changer in the Photovoltaic Scene

Abstract: The development of low-carbon technologies for energy generation is key challenge in Europe. Within the Photovoltaics (PVs) framework, the last decade has been facing a revolution with the advance of a breakthrough technology based on solution processed organometal halide perovskite solar cells (represented by CH3 NH3 PbI3), with their conversion efficiency nowadays beyond 25%, approaching those of crystalline Si cells1 . As opposed to Si solar cells, Hybrid perovskite solar cells (HPSC) are processed with low-temperature and low-cost solution-processing methods and less invasive methods2 . This results in lightweight and flexible body bearing thin and soft absorber film with modulable transparency, which bring their use in bifacial power generation devices, a field where existing Si cannot apply without extra cost of fabrication. Several assets make hybrid perovskite an exceptional PV material such as the strong and panchromatic absorption, long charge diffusion length, and extended charge carrier lifetime and mobility, and low trap density which stems for the high open circuit voltage obtained. However, presently, the technology is still not mature for industrialization. Remaining, but serious issues of perovskite PV are reinforcing the durability of performance against moisture, light and heat. Recently, I pioneered the use of layered hybrid perovskite to improve the intrinsic material stability, pushing device stability to more than 1 year under accelerated aging conditions3,4.

However, to sustain a real technological breakthrough, fundamental questions on the photophysical processes and interfacial dynamics governing device operation are utmost to address. In this talk I will discuss the enormous potential of this class of materials used in advanced solar cells, presenting their main optoelectronic properties, routes behind device development with current main limitations, actual challenges and the strategies to bring perovskites an active player in the near future PV scene.