M. Loi: ***Ultra-high sensitivity of methylammonium-lead tribromide perovskite single crystals to environmental gases***

One of the limiting factors to high device performance in photovoltaics is the presence of surface traps. Hence, the understanding and control of carrier recombination at the surface of organic-inorganic hybrid perovskite is critical for the design and optimization of devices with this material as the active layer. Here, I will demonstrate that the surface recombination rate (or surface trap state density) in methylammonium-lead tribromide (MAPbBr_3) single crystals can be fully and reversibly controlled by the physisorption of oxygen and water molecules, leading to a modulation of the photoluminescence intensity by over two orders of magnitude. We report an unusually low surface recombination velocity (SRV) of 4 cm/s (corresponding to a surface trap state density of 10^8 cm^{-2}) in this material, which is the lowest value ever reported for hybrid perovskites. In addition, a consistent modulation of the transport properties in single crystal devices is evidenced. Our findings highlight the importance of environmental conditions on the investigation and fabrication of high quality, perovskite-based devices, and offer a new potential application of these materials for detecting oxygen and water vapour.