Vacuum ablation of $CH_3NH_3SnCl_3$ Hybrid Perovskite: a tool for the sensitization of Metal Oxide Nanostructures

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Metal oxide nanostructures (NS) are attracting great interest due to the large variety of physical properties they present. Control of size, shape, surface, and assembly properties of nanoscale oxides are prerequisites to their implementation in technological devices as well as to the development of nanostructures modelled and designed to match the physical requirements of their applications. The achievement of "purpose-built" nanomaterials has been often pursued by modifying the surface of inorganic nanostructures by organic molecules (organic sensitization), so that improved or even new functional properties have been obtained. To the best of our knowledge the sensitization of metal oxide NS by organic-inorganic hybrid perovskites has not been studied, yet. Hybrid perovskites are self-assembling compounds whose properties can be tailored by varying both organic and inorganic components, so that the sensitization of metal oxide NS by these hybrids may give a path to tune the composite functionalities.

Here we investigate the sensitization of ZnO tetrapods and SnO_2 nanowires by the $CH_3NH_3SnCl_3$ hybrid perovskite via photoluminescence (PL) measurements. Hybrids were thermally ablated in vacuum on NS substrates. We show that hybrid deposition induces a different sensitization effect on the two nanostructures studied. In fact, while it affects to a negligible extent the PL of ZnO-tetrapods, hybrid deposition strongly influences the PL spectrum of SnO_2 nanowires that otherwise show the usual broad featureless PL peak centred at about 490 nm. The mechanisms which may lead to the observed results are discussed, also considering the role of the interface due to the interaction between the nanostructure matrix and deposited hybrid since the PL efficiency of the hybrid perovskite itself is low and could not justify the observed PL modifications.

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