Spongy TiO_2 layers
deposited by gig-lox sputtering processes.

Carlo Spampinato,[1,2*] Salvatore Sanzaro,[2] Salvatore Valastro[2], Emanuele Smecca[2], Giovanni Mannino[2], Fortunato Neri[1], Enza Fazio[1] and Alessandra Alberti[2].

[1] Dipartimento Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra, Università Degli Studi di Messina, Messina, Italia

[2] National Research Council-Institute for Microelectronics and Microsystems (CNR-IMM), Zona Industriale – Strada VIII no. 5, 95121 Catania, Italy.

*corresponding author: carlo.spampinato@imm.cnr.it

The use of nanostructured materials represents an improvement in many fields of applications thanks to the possibility to boost functionalities. One interesting application is in the architecture of perovskite solar cells (PSC) characterized by high photoconversion efficiency values that makes PSC able to compete with silicon solar cells. In this framework, we exploited a specific method called gig-lox, developed at CNR-IMM, to deposit TiO_2 sponges by reactive sputtering based on a grazing-incidence geometry combined with local oxidation. The experimental setup is reported in figure 1 [1]. The deposition is performed at room temperature inside a high vacuum chamber and allows depositing porous oxide layers on different substrate materials like glass, silicon, plastics. The use of substrates with different chemical/physical and mechanical characteristics is useful for wide ranging applications. Gig-lox oxides have 50% porosity in volume that spans through depths of hundreds of nanometers and consists of a forest of uniform rods separated by meso-pores (pipelines) arising from the grazing geometry. The rods, on their side, have an internal branched structure creating an interconnected network of nano-pores with sizes in the 3–5 nm range. The gig-lox TiO_2 is conceived to improve the efficiency of perovskite cells but was also used as active material for functionalization and gas sensing.

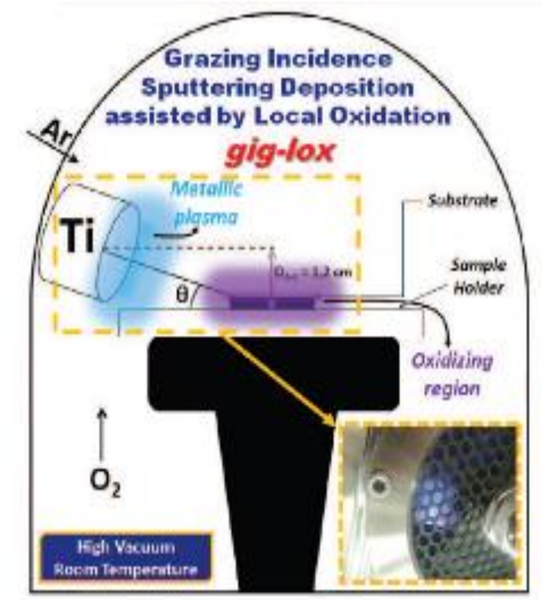

Figure 1. Customized Sputtering system, which allows for working in a separately-charged- regime of the plasma (note that the Ar and O_2 sources are separated); this is combined with shadowing effects. θ is the inclination angle of the source. The inset is a picture of the double plasma (blue is metallic and violet is oxidizing) established inside the chamber [1].

[1] S. Sanzaro, E. Smecca, G. Mannino, C. Bongiorno, G. Pellegrino, F. Neri, G. Malandrino, M. R. Catalano, G. G. Condorelli, R. Iacobellis, L. De Marco, C. Spinella, A. La Magna and A. Alberti: Sci. Rep., 2016, 6, 39509.