Development of multifunctional TiO_2/MWCNT hybrid composite grafted on stainless-steel grating.

Sara Cravanzola[a], Sagar M. Jain[a,b], Federico Cesano[a], Alessandro Damin[a] and Domenica Scarano[a]*

[a] Department of Chemistry, NIS (Nanostructured Interfaces and Surfaces) Interdepartmental Centre and INSTM Centro Di Riferimento, University of Torino, Via P. Giuria, 7, 10125 Torino, Italy.
*E-mail: federico.cesano@unito.it

[b] current address: sagarmjain@gmail.com.

Electronic Supplementary Information (ESI).

The morphology and the chemical analysis of the stainless steel grating are reported in Fig. S1. From the EDAX spectrum the chemical composition (Fe 66wt%, Cr 17.9 wt%, Ni 8 wt%, Si ≈0.4wt%) is obtained. The steel exhibits excellent withstanding properties, from the strong corrosion resistance to a wide range of atmospheric and chemical compounds to the excellent oxidation resistance (up to 900°C).

The BET surface area and the pore size distributions (PSDs) of the TiO_2/MWCNTs hybrid structure (obtained from the stainless steel support) and of the pure TiO_2 material (prepared by the same sol-gel and calcinations methods), as obtained from volumetric N_2 adsorption/desorption isotherms are shown in Fig. S2a,b

In Fig. S3 the scheme of the structure of methylene blue along the three perpendicular directions is reported.

PL spectra of TiO_2/MWCNTs/stainless steel composite and of the discrete TiO_2 nanoparticles, obtained by adopting the same sol-gel preparation and treated at the same temperature are reported in Fig. S4.

The evolution of the surface properties (from the hydrophobic type of the MWCNTs/steel composite to the hydrophilic type of the TiO_2/MWCNTs/steel composite) is optically imaged in Fig. S5.

The quantities of TiO_2 and of MWCNTs of the composites have been obtained by means of the thermogravimetric profile upon isothermal oxidative conditions at 800°C (Fig. S6).

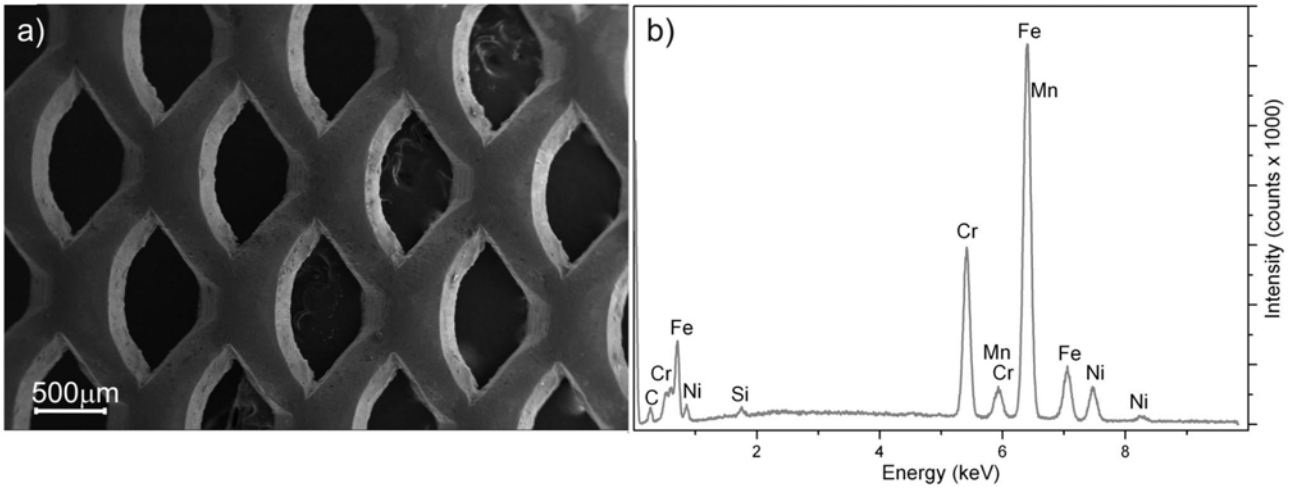

Fig. S1. A) SEM image and b) EDAX spectrum of the stainless steel grating used as a support.

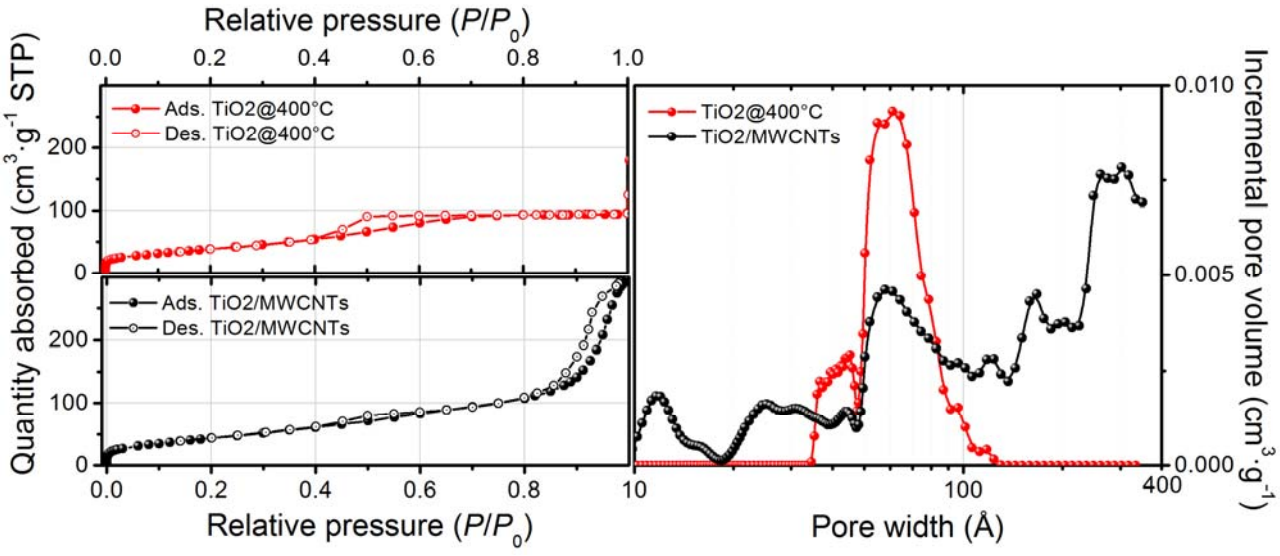

Fig. S2. N_2-absorption/desorption isotherms (left panels) and pore size distributions (right panel) of the TiO_2 obtained at 400°C in air and of the TiO_2/MWCNT hybrid scaffold obtained from the stainless-steel support.

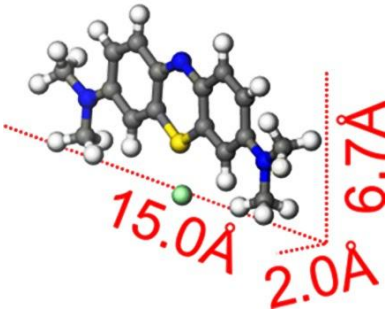

Fig. S3. Structure of methylene blue. The interatomic distances are reported along the three perpendicular directions.

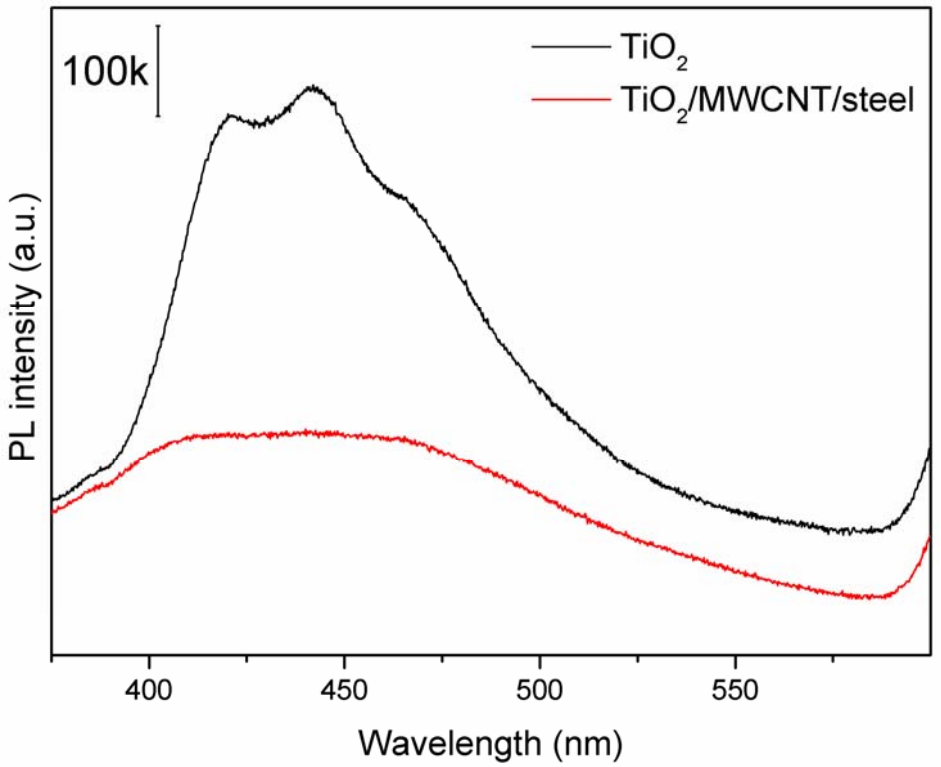

Fig. S4. PL emission spectra of TiO_2/MWCNTs/steel composite and of TiO_2 reference material (P25).

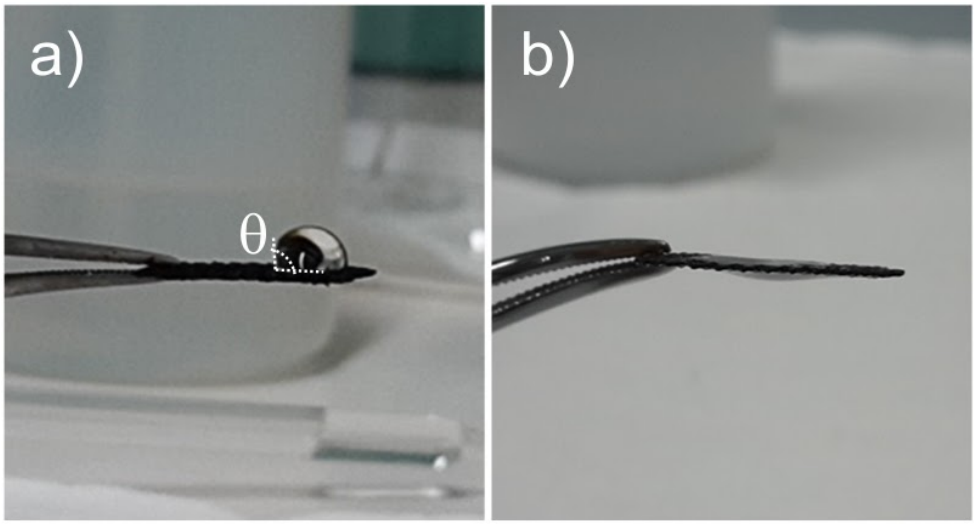

Fig. S5. Optical images showing the evolution of the surface properties (from hydrophobic type to hydrophilic type) of: a) the stainless steel grating covered by catalytically grown MWCNTs; and b) the same MWCNTs/steel composite coated with TiO_2.

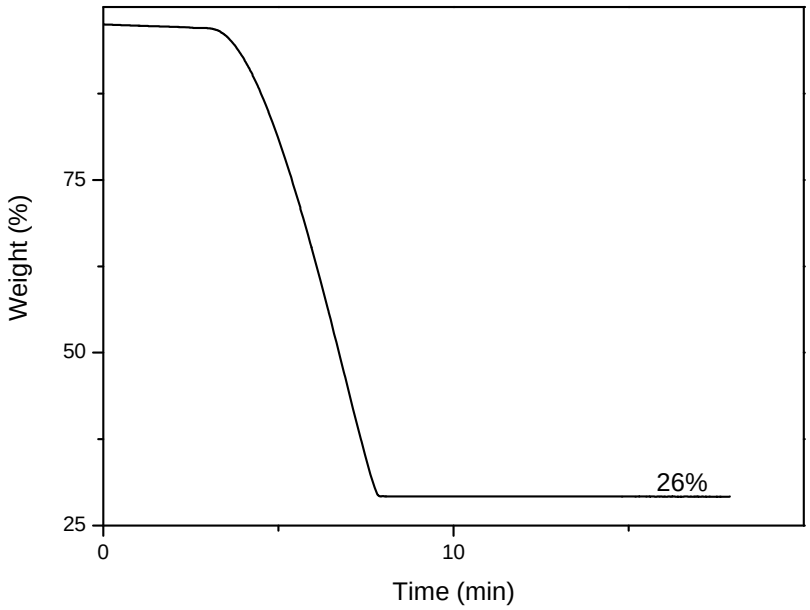

Fig. S6. Thermogravimetric profile of the TiO_2/MWCNTs/stainless steel grid under isothermal treatment at 800°C in air, after the heating in N_2 (ramp, stage 1).