Fast antibacterial kinetics of metal oxides coated polymers

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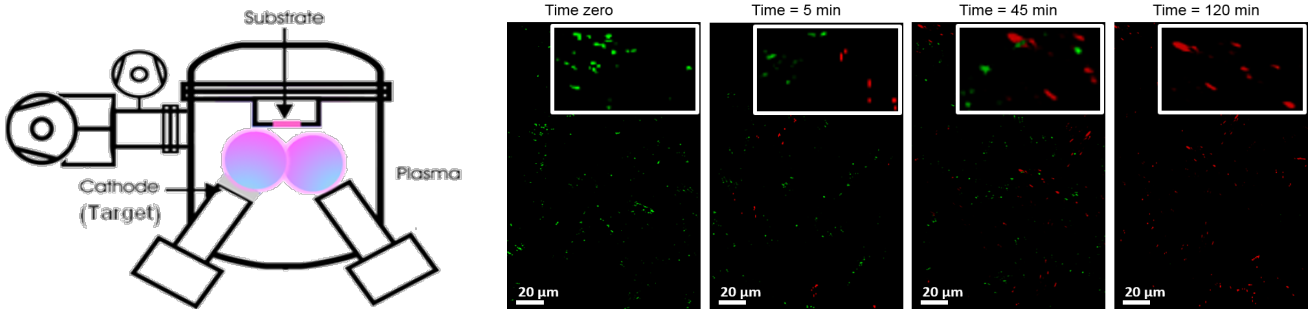
Compact uniform and adhesive TiO_2 deposited on thin polymer PE-films have been prepared by DC-magnetron sputtering (DCMS). TiO_2 sputtered on polyethylene (PE) showed effective and fast bacterial reduction kinetics and methylene blue (MB) self-cleaning properties under low intensity solar light [1-2].



During the bacterial inactivation, the shift in the vibrational peaks of the infrared -CH_2 bands was attributed to the increase in the -CH_2 bond stretching taking place preceding bond lysis and complete bacterial inactivation. The bacterial inactivation time was concomitant with the time required for the hydrophobic to hydrophilic transformation on PE-TiO_2 surface under band-gap irradiation [3]. The production of malondialdehyde (MDA) was observed during *E. coli* loss of viability.

The first evidence for Cu−Ag (50%/50%) nanoparticulate hybrid coatings is presented leading to a complete and almost instantaneous bacterial inactivation in the dark (≤5 min). Dark bacterial inactivation times on Cu−Ag (50%/50%) were observed to coincide with the times required by actinic light irradiation on 3D polyurethane catheters. This provides the evidence that the bimetal Cu-Ag driven inactivation predominates over a CuO/Cu_2O and Ag_2O oxides inducing a semiconductor driven behavior. Cu- or Ag-coated polyurethane catheters led to bacterial inactivation needing about ~30 min.

These PE-TiO_2 and other metals/metal oxides sputtered surfaces present a potential practical application for the disinfection since they preclude the formation of biofilms on PE, polyurethane and medical textiles [4-5].

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[2] S. Rtimi, C. Pulgarin, R. Sanjines, J. Kiwi, Applied Catalysis B: Environmental 162 (2015) 236-244.
[3] S. Rtimi, C. Pulgarin, J. Kiwi, RSC Advances 3 (2013) 16345-16348
[4] S. Rtimi, S. Giannakis, M. Bensimon, C. Pulgarin, R. Sanjines, J. Kiwi, Applied Catalysis B: Environmental 191 (2016) 42-52.
[5] S. Rtimi, R. Sanjines, C. Pulgarin, J. Kiwi, ACS-Applied Materials Interfaces 8 (2016) 47-55