Fast antibacterial kinetics of metal oxides coated polyethylene

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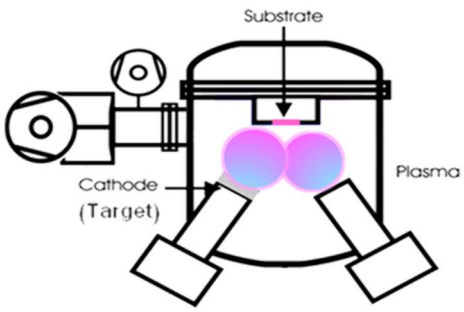
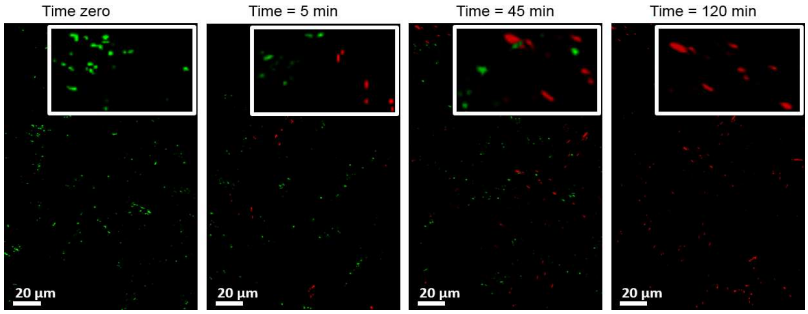
Compact uniform and adhesive TiO_2 deposited on thin polymer PE-films have been prepared by DC-magnetron sputtering (DCMS). TiO_2 sputtered on polyethylene (PE) showed effective and fast bacterial reduction kinetics and methylene blue (MB) self-cleaning properties under low intensity solar light [1-2].





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

The transparent PE-TiO_2 sputtered films have also shown to be self-cleaning under light irradiation. These films lead to the fast discoloration of methylene blue (MB) under low intensity solar simulated light. The MB^*/MB^+ potential band positions allows for the electron injection into the TiO_2cb and the production of oxidative species leading to the self-cleaning effect. The probability for the short-lived MB^+ cation self-deactivation and of the MB^* excited state reacting with O_2 leading to MB-discoloration was estimated.

[1] S. Rtimi, R. Sanjines, C. Pulgarin, A. Kulik, J. Kiwi, Surface & Coatings Technology 2014, 254, 333-343.
[2] S. Rtimi, C. Pulgarin, R. Sanjines, J. Kiwi, Applied Catalysis B: Environmental, 2015, 162, 236-244.
[3] S. Rtimi, C. Pulgarin, J. Kiwi, RSC Advances, 2013, 3, 16345-16348
[4] S. Rtimi, S. Giannakis, M. Bensimon, C. Pulgarin, R. Sanjines, J. Kiwi, Applied Catalysis B: Environmental 191 (2016) 42-52.