Continuous Photocatalytic Antibacterial Activity of AgNPs doped TiO_2 Digital Printed on Commercial Porcelain-grès Tiles

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Photocatalytic finishing materials, such as tiles or paints, are a productive as well as scientific reality. One of the most interesting photocatalytic material currently on the market is the porcelain stoneware which combines the beauty of a design product with hardness and absence of porosity and thus used for both floors and walls. The Ag-micrometric TiO_2 allowed active ceramic slabs to be active under LED lights, bypassing the problem of the UVA radiation. SEM/TEM images in Fig. 1 indicate the full coverage of the porcelain surface (left image), besides a nanometric though heterogenous spreading of the AgNPs on top of the TiO_2 matrix (right image).

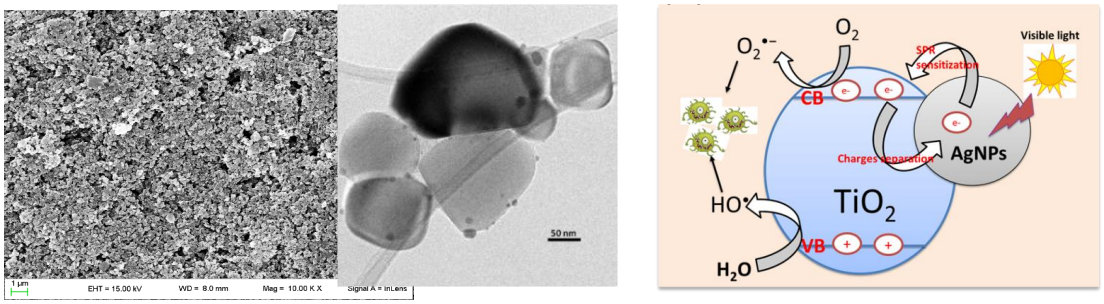

Figure 1. HR-SEM of the Active ceramic surface (left), TEM image of 8% AgNPs-TiO_2(center); possible photocatalytic mechanistic pathways in Ag doped TiO_2 system (right)

An important question concerns the antibacterial action: in fact, today the role of silver is unknown when the metal is physically blocked on a surface and cannot penetrate and therefore interfere at the DNA level in the cellular barrier. The prepared porcelain Ag-TiO_2 printed surfaces were tested against *E. coli* under solar and visible illumination and in the dark. To differenciate the semicondutor behavior and the ions mediated bacterial inactivation mechanism, porinless *E. coli* were used under band-gap irradiation. Stereomicroscopy analysis showed dead bacteria within 180 and 240 min respectively for normal *E. coli* and porinless *E. coli*. Using appropriate quenchers, the bacterial inactivation mechanisms under solar and visible light are proposed.

Keywords: photocatalytic material, antibacterial, silver, bacterial inactivation, LED, visible light