Micro – TiO_2 as photocatalyst for new ceramic surfaces activated via digital printing

Claudia L. Bianchi[1], Marta Stucchi[1], Carlo Pirola[1], Giuseppina Cerrato[2], Alessandro DiMichele[3], Valentino Capucci[4]

[1]*Dipartimento di Chimica, Università degli Studi di Milano, & Consorzio INSTM, Milano, Italy*
email: claudia.bianchi@unimi.it , web site: http:// http://bianchi.chimica.unimi.it

[2]*Dipartimento di Chimica, Università degli Studi di Torino & Consorzio INSTM, Torino, Italy*

[3]*Dipartimento di Fisica e Geologia, Università degli Studi di Perugia, Perugia, Italy*

[4]*GranitiFiandre SpA, Fiorano M.se (MO), Italy*

Air pollution has a negative impact for citizens' health, reducing human life expectancy by more than 8 months on average, and by more than 2 years in the most polluted areas. Photocatalytic surfaces might play a major role in cleaning indoor and outdoor environments.

New industrially produced photocatalytic tiles provide very good photocatalytic performance [1], but also meet standard requirements with respect to hardness, lack of porosity, vitrified surface, durability. The digital printing was exploited as a new tool to manufacture photocatalytic tiles even of very large size (150x300 cm). The ink preparation was carefully checked in order to have a stable and reproducible product able to work with the print heads commercially available in the market.

In the preparation, a commercial micro-TiO_2 (Kronos) was employed to avoid the use of traditional TiO_2 nanomaterials in powdery form (see Fig.1 left side) [2]. The use of the micrometric TiO_2 is very interesting because of the negative issues of nanometric powders: the latter could be easily inhaled and their particles could cause pulmonary inflammation, etc.. Although negative TiO_2's effects on human health have not been fully demonstrated yet, some tests on animals have evidenced that nanoparticles are very dangerous and they have a higher potential to cause cancer, in particular lung cancer.

The surface of the photoactivated slabs was analyzed by HR-SEM (Fig.1, central and right side). An excellent uniformity of the TiO_2 micro-sized particles can be observed.

Photocatalytic degradation tests performed in air using both NOx and ethanol as model VOC pollutants confirm the good performance of the tiles to tackle the environmental pollution [3,4].

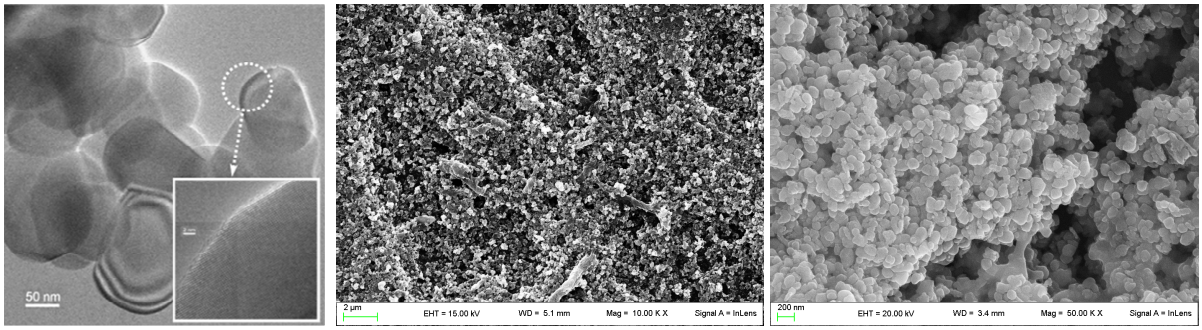

Fig1. HR-TEM micrograph of Kronos micro-TiO_2 (left side). HR-SEM picture of Active labs surface: 10K (central) and 50 KX (right side)

1. C.L. Bianchi, S. Gatto, C. Pirola, M. Scavini, V. Capucci, CCC, 36 (2013) 116
2. C.L Bianchi, C. Pirola, F. Galli, G. Cerrato, S. Morandi, V. Capucci, Chem. Eng J, 261, (2015) 76
3. C.L. Bianchi, S. Gatto, C. Pirola, A. Naldoni, A. Di Michele, G. Cerrato, V. Crocellà, V. Capucci, Appl. Catal. B: Env., 146 (2014) 123
4. G. Cerrato, C.L. Bianchi, S. Morandi, C. Pirola, M. Stucchi, M.V Diamanti, M.P. Pedeferri, V. Capucci, Energy and Environment Focus, 4 (2015) 226

Presentation Method (Invited/Regular Oral/Poster): INVITED