

PhD Candidate Profile

Name:

Stefano Alberti

Research Group (if relevant):

Laboratory of materials and models for energetic application, environmental protection and cultural heritage conservation

Research Centre (if relevant):

N/A

Department/School(s) (if relevant):

Department of Chemistry and Industrial Chemistry

College:

University of Genoa, GE, Italy

Supervisor(s):

Prof. Maurizio Ferretti

Funding body:

N/A

Area (field) of study:

Heterogeneous photocatalysis (TiO_2) used for emerging pollution related issues: wastewater treatment and multidrug resistant bacteria inactivation

Thesis Title:

Synthesis, characterization and optimization of TiO_2 based photocatalytic devices for environmental applications related to emerging pollution

Abstract:

Pharmaceuticals and personal care products (PPCPs), a new category of synthetic organic compounds, are characterized by a multitude of different physical-chemical properties. The market of pharmaceuticals is estimated to be around 200000 ton/year and it has to be considered that actual wastewater treatment plants (WWTPs) are not designed to degrade these kind of molecules. Their continuative replenishment in the environment has led to a persistent pollution which concerns waters and soil. Furthermore, the presence of antibiotics where bacteria live and reproduce resulted in the development of antibiotic resistant genes, able to let bacteria unaffected by antimicrobial drugs.

As heterogeneous photocatalysis is a promising sustainable way to counteract this kind of hazard, TiO_2 was chosen as object of this thesis. More in particular, this advanced oxidation process (AOP) can be activated by both artificial and solar light and is highly reactive against organic stable compounds, like PPCPs are, as well as antibiotic resistant bacteria. TiO_2



nanoparticles are synthesized bare and doped, in order to have an Energy gap shift towards the visible region, and they are further processed, with different techniques, to be supported on innovative materials, like persistent luminescence materials (PeLs), magnetic zeolites and polymeric films. The optimization of the supported photocatalytic devices can lead to a sustainable and recyclable AOP that can be exploited for environmental issues in real cases.

Collaborations:

University of Pavia, Department of Analytical Chemistry and Photochemistry

University of Kuwait, Department of Chemistry

University of Crete (ongoing), Department of Environmental Engineering

University of Genoa, Department of Integrated Surgical and Diagnostics Sciences

Publications:

- Porous Polydimethylsiloxane membranes loaded with low-temperature crystallized TiO₂ NPs for detachable antibacterial films – S. Alberti, M. Ferretti, S. Vicini, M. Castellano, V. Caratto – accepted on August 30th 2018 in Journal of Materials Science – DOI 10.1007/s10853-018-2881-4
- Photocatalysis in darkness. Optimization of sol-gel synthesis of NP-TiO₂ supported on a persistent luminescence material and its application for the removal of Ofloxacin from water – S. Alberti, F. Locardi, M. Sturini, A. Speltini, F. Maraschi, G.A. Costa, M. Ferretti, V. Caratto –Journal of Nanomedicine and Nanotechnology 2018, 9:3, 501– DOI 10.4172/2157-7439.1000501
- Systematic study on TiO₂ crystallization via hydrothermal synthesis in the presence of different ferrite nanoparticles as nucleation seeds – V. Caratto, S. Alberti, S. Villa, G. Singh, F. Seland, A. Martinelli, M. Ferretti, F. Canepa – currently in press under invitation in Journal of Nanoscience and Nanotechnology – special issue “Nanostructured Spinel Ferrites” on July 27th 2017
- Structural studies on copper and nitrogen doped nanosized anatase – A. Martinelli, S. Alberti, V. Caratto, P. Lova, F. Locardi, G. Pampararo, S. Villa, M. Ferretti currently in press in Zeitschrift fuer Kristallographie – Crystalline Materials on June 1st 2018 - DOI: <https://doi.org/10.1515/zkri-2017-2143>
- Antibacterial activity of standard and N-doped titanium dioxide-coated endotracheal tubes: an in-vitro study – V. Caratto, L. Ball, E. Sanguineti, A. Insorsi, I. Firpo, S. Alberti, M. Ferretti, P. Pelosi – Revista Brasileira de Terapia Intensiva 2017 - DOI: 10.5935/0103-507X.20170009
- Different sol-gel preparations of iron-doped TiO₂ nanoparticles: characterization, photocatalytic activity and cytotoxicity – V.Caratto, F.Locardi, S.Alberti, E.Sanguineti, A.Martinelli, T.Balbi, L.Canesi, M.Ferretti – Journal of Sol-Gel Science and Technologies - 2016, DOI 10.1007/s10971-016-4057-5.

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- Enhancement of TiO₂ NPs activity by Fe₃O₄ nano-seeds for removal of organic pollutants in water - S. Villa, V. Caratto, F. Locardi, S. Alberti, M. Sturini, A. Speltini, F. Maraschi, F. Canepa, M. Ferretti – Materials - 2016, 9, 771, DOI 10.3390/ma9090771

Presentations:

- “Porous PDMS membranes loaded with bare and N-doped TiO₂ NPs for antibacterial coatings” – S. Alberti, I. Basciu, A. Saperdi, S. Vicini, M. Castellano, M. Ferretti, V. Caratto - CABC2018 “XVII Congresso Nazionale di Chimica dell’ambiente e dei Beni Culturali: la tutela dell’ambiente e dei beni culturali in un mondo che cambia” - Genova - Italy, June 24th-27th 2018 – oral presentation
- “Porous PDMS membranes loaded with TiO₂ NPs for detachable antibacterial coatings” – S. Alberti, I. Basciu, S. Vicini, M. Castellano, M. Ferretti, V. Caratto – GIFC18 “IX Edizione delle Giornate Italo-Francesi” – Genova – Italy, April 16th-18th 2018 – oral presentation
- “PDMS membranes loaded with undoped and doped TiO₂ NPs for antibacterial activity” - S. Alberti, V. Caratto, M. Mauri, S. Vicini, M. Castellano, M. Ferretti – Applied Nanotechnology and Nanoscience International Conference “ANNIC2017” - Roma – Italy, October 18th-20th 2017 – oral presentation
- “Removal of pollutants of emerging concern and the treatment of turbid wastewaters: optimization of the synthesis of NP-TiO₂ supported on a persistent luminescence material” - S. Alberti, V. Caratto, F. Locardi, M. Ferretti, G.A. Costa, M. Sturini, A. Speltini, F. Maraschi – International Conference on Chemistry and the Environment “ICCE2017” – Oslo – Norway, June 18th-22nd 2017 – oral presentation