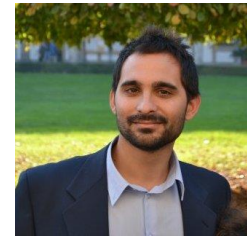


Name **Carlo Bianco**
Date of Birth 14-Dic-1988
Place of Birth Siracusa (SR)
Nationality Italian
Address Via Matilde Serao 11, 10141 Torino
E-mail carlo.bianco@polito.it



Web Site www.polito.it/groundwater/team/carlo-bianco
Phone number (0039)-011-0907611
(0039)-328-8475027

PRESENT POSITION

January 2017 -today **Postdoctoral Fellowship** at the Department of Environment, Land and Infrastructure Engineering (DIATI) of Politecnico di Torino (Italy).

Tutors: Prof. Rajandrea Sethi, Prof. Tiziana Tosco

Topic: Optimization and modeling of the injection and transport of colloidal particles in groundwater systems for the remediation of contaminated aquifers

I am part of the **Groundwater Engineering Research Group** (www.polito.it/groundwater) at DIATI – Politecnico di Torino, headed by prof. Rajandrea Sethi. My research activities involve groundwater characterization, contaminated site remediation, solute and colloid transport in porous media, risk assessment, nanoparticles for groundwater remediation. In particular, my recent research focuses on the optimization of large-scale applications of nanotechnologies for groundwater remediation, including both experiments and development of numerical models for the assisted design of field scale implementations. The problem is faced from an experimental point of view, mainly through transport tests (in 1D and 2D domains), colloidal stability tests and rheological measurements, and from a modeling point of view, developing an integrated experimental-modeling approach to characterize and simulate colloid transport at different time and space scales.

I am currently involved in both research and technology transfer activities.

EDUCATION

2014-2017 **PhD Program in Environmental Engineering** (29th cycle) at Politecnico di Torino (Italy)
PhD defense on the 04/07/2017. Mark: Excellent cum Laude

Tutors: Prof. Rajandrea Sethi, Dr. Tiziana Tosco

Title of thesis: Modelling of the injection and long-term fate of nanoparticles in groundwater systems.

Topic: My research focused on the development and application of particle-based remediation technologies. This work was carried out in the framework of two European research projects, namely Nanorem (FP7) and Reground (H2020).

Groundwater remediation based on particle injection has been extensively studied in the last decade, leading to a technology mature for field applications. In my research I focused on those aspects related to the injection of nanoparticles, working at both laboratory and field scale, including experiments, field injections and model development. The results of this research lead to the development of two modeling tools, MNMs and MNM3D. In particular, MNM3D allows the field-scale simulation of colloid transport and can be applied both for the estimation of the long-term fate of nanoparticles released in groundwater systems (eg. in landfill leachate) and for the design of full-scale remediation using nanoparticles. During my PhD, I applied the MNM3D code to support the design of a field

scale injection of iron oxide nanoparticles carried out in the frame of the European project Reground. Finally, I developed an innovative (patent pending) and model-assisted approach to control the transport and deposition of nanoparticles in aquifer systems.

2013 Master of Science's Degree in Environmental Engineering at Politecnico di Torino.
Mark: 110/110

Title of thesis: Implementing colloidal and nanoparticles transport on RT3D/MODFLOW: from laboratory to pilot scale.

Tutors: Prof. Rajandrea Sethi, Dr. Tiziana Tosco (Politecnico di Torino), Prof. Majid S. Hassanizadeh (Utrecht University, The Netherlands)

2011 Bachelor Degree in Environmental Engineering at Politecnico di Torino.
Mark: 108/110.

Title of thesis: Analisi dell'inquinamento della falda del sito di interesse nazionale di Priolo (Characterization of the groundwater pollution in the site of national interest of Priolo).

Tutor: Prof. Maurizio Onofrio

ABROAD EXPERIENCES

2015 Visiting PhD at the Catholic University of Leuven (Belgium) for 3 months, under the supervision of Prof. Erik Smolders (Division of Soil and Water Management).
Research activity carried out in the framework of the European Project *Reground* (H2020, G.A. 641768).

2013 Visiting during the Master Thesis project at Deltares, Institute of applied research, and at Utrecht University (The Netherlands) for 4 months, under the supervision of Prof. M.S. Hassanizadeh.
Research activity carried out in the framework of the European Project *NanoRem* (FP7, G.A. 309517).

PROJECTS AND RESEARCH PROGRAMS

2018-today Principal investigator in the project "**AQUIREM**", funded by Politecnico di Torino and LIFT.

The project is funded in the **Proof of Concept** project framework of Politecnico di Torino, aimed at supporting the implementation, demonstration and up-scaling of recent patents filed by researchers. The project focuses on a patent application we filed in 2018 concerning a new approach to innovate the classical concept of contaminated aquifers nanoremediation.

2017-2018 Principal investigator in the project "**NanoTune - Optimizing Nanoremediation**", funded by Politecnico di Torino and Compagnia di San Paolo.

The project was funded in the **Proof of Concept** project framework of Politecnico di Torino. The project focuses on a patent application filed in 2016 concerning a new methodology for in situ groundwater remediation by controlling the injection and immobilization of nanoparticles, in order to create a reactive zone within a target area and minimize the risk of long-term release of the nanoparticles.

2017-today Participant in the research project "**NANOGRASS** - Development of a NANO-herbicide formulation to minimize the impact of aGROchemicals on Soil and Subsoil", funded by Compagnia di San Paolo and Politecnico di Torino.

NANOGRASS aims at minimizing the environmental impact of herbicides by developing and

testing a new environmentally friendly nano-formulation for their optimized delivery. A biodegradable formulation will ensure a slow, controlled release of the herbicides, thus reducing losses due to leaching in the subsoil and volatilization. Moreover, it will avoid any potential risk associated to the presence of residual, synthetic NPs in the subsoil, which is typical of nanopesticides based on non-biodegradable carriers. The approach followed in NANOGRASS will be potentially applicable to other agrochemicals, thus opening perspectives for a family of nano-formulated products with minimal environmental impact.

2017-today Participant in the applied research project “Studio ed ottimizzazione del trasporto di sospensioni di nanoparticelle ferrose per la bonifica di sistemi acquiferi” (**Study and optimization of iron-based nanoparticle suspensions for the remediation of contaminated aquifers**), funded by ENI S.p.A. and Syndial servizi ambientali S.p.A.

2015-today Participant in the European Research Project “**REGROUND** - Colloidal Iron Oxide Nanoparticles for the REclamation of Toxic Metal Contaminated GROUNDwater aquifers, drinking water wells, and river bank filtrations”, Horizon 2020, Grant Agreement No. 641768.

REGROUND aims at the application and up-scaling to market of a remediation technology based on the use of nanomaterials, which has already been developed in previous projects. Goal of the project is to create a market-ready application to mitigate the risks posed by toxic metal contaminations to humans and ecosystems. Goethite nanoparticles are being applied for the removal of heavy metals from two contaminated sites.

2014-2016 Participant in the European Research Project “**NANOREM** - Taking nanotechnological remediation processes from lab scale to end user applications for the restoration of a clean environment”, FP7/2007-2013, Grant Agreement No. 309517.

The project focused on the development of a remediation technology involving the injection of iron-based nanoparticles in the subsoil. The research unit of Politecnico di Torino worked on modelling nanoparticle transport in porous media. In Nanorem the modelling tools MNMs (1D domains) and MNM3D (3D domains) for the simulation of colloid transport in porous media were developed.

SOFTWARE

I have developed the following software (<http://www.polito.it/groundwater/software>):

- **MNMs** (Micro-and Nanoparticle transport, filtration and clogging Model - Suite), software tool for the simulation of solute and particle transport in saturated porous media. It provides analytical solutions to solute transport equations and implements a finite differences numerical models for particle transport in 1D cartesian and radial geometry embedded in a user-friendly graphical interface.
- The modeling tool **MNM3D** (Micro and Nanoparticles transport Model in 3D geometries), implementing in 3D the particle transport equations included in MNMs, was developed for the prediction of the long-term behavior of engineered nanoparticles released in the environment (eg. from landfills), and the preliminary design of in situ aquifer remediation through injection of suspensions of reactive particles. MNM3D is based on the well-known reactive transport module RT3D, which is implemented in commercial software widely used for groundwater contamination studies and remediation design.

PATENTS

- Sethi R., **Bianco C.**, Tiraferri A., Tosco T., Patino Higueta J.E., “NanoTune”, Patent Pending – Filing Date: December 2016
- Sethi R., **Bianco C.**, Gallo A., Tiraferri A., Tosco T. “CoMet”, Patent Pending – Filing Date: November 2017

- Sethi R., **Bianco C.**, Gallo A., Tosco T. "AquiRem", Patent Pending – Filing Date: October 2018

AWARDS

- Remtech Degree & Ph.D. Awards 2014 for the best Master Thesis, titled: "Implementing colloidal and nanoparticles transport on RT3D/MODFLOW: from laboratory to pilot scale"

TEACHING ACTIVITIES

Lecturer for the following short courses:

- Tufenkji N., Ghoshal S., Sethi R., Tiraferri A., Bonelli B., Tosco T., **Bianco C.**, Coisson M., "Nanoparticles and water resources", Politecnico di Torino, DIATI, Torino, Italy 11-12 July 2016
- Sethi R., Tosco T., **Bianco C.**, "MNMs: A modelling tool for nanoparticle transport in porous media", Congress Center Padova "A. Luciani", Padova, Italy 21-22 May 2015
- Sethi R., Tosco T., **Bianco C.**, Raoof A. "Modeling the transport of nanoparticles in porous media", University of Vienna, Department of Environmental Geosciences 21-10-11 April 2014

I co-tutored more than 20 Master students.

- 2017-2020 Laboratory assistant during the Master course of "Groundwater Engineering", given by Prof. Rajandrea Sethi at Politecnico di Torino
- 2016-2017 Laboratory assistant during the Master course of "Numerical methods and scientific calculus", given by Prof. Sandra Pieraccini at Politecnico di Torino

LIST OF PUBLICATION AND CONFERENCES

- JOURNAL PAPERS**
- Casasso, A., Ferrantello, N., Pescarmona, S., **Bianco, C.**, Sethi, R., "Can borehole heat exchangers trigger cross-contamination between aquifers?", (2020) Water (Switzerland), DOI: 10.3390/W12041174
 - Velimirovic, M., **Bianco, C.**, Ferrantello, N., Tosco, T., Casasso, A., Sethi, R., Schmid, D., Wagner, S., Miyajima, K., Klaas, N., Meckenstock, R.U., von der Kammer, F., Hofmann, T., "A large-scale 3D study on transport of humic acid-coated goethite nanoparticles for aquifer remediation", (2020) Water (Switzerland), DOI: 10.3390/W12041207
 - Mondino, F., Piscitello, A., **Bianco, C.**, Gallo, A., de Folly D'Auris, A., Tosco, T., Tagliabue, M., Sethi, R., "Injection of zerovalent iron gels for aquifer nanoremediation: Lab experiments and modelling", (2020) Water (Switzerland), DOI: 10.3390/w12030826
 - Casasso, A., Tosco, T., **Bianco, C.**, Bucci, A., Sethi, R., "How can we make pump and treat systems more energetically sustainable?", (2020) Water (Switzerland), DOI: 10.3390/w12010067
 - Beryani, A., Alavi Moghaddam, M.R., Tosco, T., **Bianco, C.**, Hosseini, S.M., Kowsari, E., Sethi, R., "Key factors affecting graphene oxide transport in saturated porous media", (2020) Science of the Total Environment, DOI: 10.1016/j.scitotenv.2019.134224
 - Gallo, A., **Bianco, C.**, Tosco, T., Sethi, R., "Characterization and reactivity of novel

silver/iron nanoparticles”, (2019) *Materials Today: Proceedings*, DOI: 10.1016/j.matpr.2019.07.651

- **Bianco, C.**, Tosco, T., Casasso, A., Marchese, F., Sethi, R., “Extension of human health risk assessment procedure to nanomaterial contaminations in aquifer systems [Estensione dell'analisi di rischio sanitario ambientale a contaminazioni di nanomateriali in sistemi acquiferi]”, (2019) *Geoingegneria Ambientale e Mineraria*
- Gallo, A., **Bianco, C.**, Tosco, T., Sethi, R., “Zerovalent iron for the remediation of contaminated aquifers. [Ferro zerovalente nanoscopico per la bonifica di acquiferi contaminati]”, (2018) *Geoingegneria Ambientale e Mineraria*
- Gallo A., **Bianco, C.**, Tosco, T., Tiraferri, A., Sethi, R., “Synthesis of eco-compatible bimetallic silver/iron nanoparticles for water remediation and reactivity assessment on bromophenol blue”, (2019) *Journal of Cleaner Production*, DOI: 10.1016/j.jclepro.2018.10.298
- **Bianco, C.**, Patiño Higueta, J. E., Tosco, T., Tiraferri, A., Sethi, R., “Controlled Deposition of Particles in Porous Media for Effective Aquifer Nanoremediation”, (2017) *Scientific Reports*, Nature Publishing Group, ISSN 2045-2322, DOI: 10.1038/s41598-017-13423-y
- Tiraferri A., Saldarriaga Hernandez L. A., **Bianco C.**, Tosco T., Sethi R., “Colloidal behavior of goethite nanoparticles modified with humic acid and implications for aquifer reclamation.” (2017) *Journal of Nanoparticle Research* 19:107. ISSN 1388-0764, DOI:10.1007/s11051-017-3814-x
- **Bianco C.**, Tosco T., Sethi R., “A 3-dimensional micro- and nanoparticle transport and filtration model (MNM3D) applied to the migration of carbon-based nanomaterials in porous media”, *Journal of Contaminant Hydrology*, Volume 193, October 2016, Pages 10-20, ISSN 0169-7722, DOI: 10.1016/j.jconhyd.2016.08.006.

BOOK CHAPTERS

- Tosco T., **Bianco C.**, Sethi R., “An Integrated Experimental and Modeling Approach to Assess the Mobility of Iron-based Nanoparticles in Groundwater Systems”, (2018), Book chapter in: “Iron nanomaterials for water and soil treatment”, Editors: Marta I. Litter, Natalia Quici, Martin Meichtry - Pan Stanford Publishing, ISBN 9781351334792.

INVITED SPEAKER AT CONFERENCES

- “Nanotune: strategia innovativa per l’iniezione controllata di sospensioni colloidali reattive in acquiferi contaminati” (Nanotune: an innovative strategy to control the injection of suspensions of reactive colloids in contaminated aquifers). Presented at the seminary “Reagenti Innovativi nelle bonifiche di siti contaminati” (Innovative reagents for the remediation of contaminated sites) at the conference Remtech 2017, Ferrara, 20-22 September 2017

CONFERENCES

- **Bianco C.**, Tosco T., Sethi R. “MNM3D: a modelling tool for simulation of nanoparticle injection and transport in 3D geometries.” - Aquaconsoil 2017 - 14th International Conference on Sustainable Use and Management of Soil, Sediment and Water Resources, 26-30 June 2017, Lyon, France.
- **Bianco C.**, Tosco T., Sethi R. “Simulating nanoparticle transport in 3D geometries with MNM3D.” - EGU General Assembly 2017, 8-13 April 2017, Vienna, Austria.
- Tosco T., **Bianco C.**, Sethi R. “Transport models for risk assessment of natural and engineered nanoparticles in groundwater.” - Aquaconsoil 2017 - 14th International Conference on Sustainable Use and Management of Soil, Sediment and Water Resources, 26-30 June 2017, Lyon, France.
- **Bianco C.**, Tosco T., Sethi R. (2017). MNM3D: a modelling tool for simulation of nanoparticle injection and transport in 3D geometries. In: *Interpore – 9th International Conference on Porous Media & Annual Meeting*, 8-11 May 2017 Rotterdam, The Netherlands.
- Tiraferri A., Saldarriaga Hernandez L. A., **Bianco C.**, Tosco T., Sethi R. “Water Chemistry Affects the Efficacy of Concentrated Suspensions of Iron Oxide Nanoparticles Used for Aquifer Reclamation” - IAP2016 "Interfaces Against Pollution" – Lleida, Spain, September 4-7, 2016
- **Bianco C.**, Tosco T., Sethi R. (2015) “Modelling the injection and the long-term fate

- of nanoparticle suspensions in groundwater” *GIT – Geosciences and Information Technology, XI Convegno Nazionale*, Torino (ITA), 13-15 June 2016.
- Sethi R., Tosco T., **Bianco C.** (2015) “MNMs: a model for the simulation of depth filtration of non-Newtonian suspensions in granular media.” *Filtech 2015, International Conference & Exhibition for Filtration and Separation Technology*, Cologne - Germany, 24-26 February. p. 135
 - **Bianco C.**, Tosco T., Sethi R. (2015) “Modelling field-scale injection and transport of nanoparticles suspensions in 3D geometries” *7th International Conference on Porous Media & Annual Meeting*, Padova (ITA), 18-21 Maggio 2015.
 - Tosco T., **Bianco C.**, Sethi R. (2015) “Modelling nanoparticle transport in porous media across the scales: from pore network models to simulation of field injection” *Aquaconsoil 2015. 13th International UFZ-Deltares Conference on Sustainable Use and Management of Soil, Sediment and Water Resources*, Copenhagen, Denmark, 9–12 June 2015.
 - **Bianco C.**, Tosco T., Sethi R. (2015) “Simulation of the transport of nanofluids in porous media: particle deposition and clogging phenomena” *7th International Conference on Porous Media & Annual Meeting*, Padova (ITA), 18-21 Maggio 2015.
 - Tosco T., **Bianco C.**, Sethi R. (2014) “MNMs: a numerical model for the simulation of nanoparticles transport from landfills under transient ionic strength” *COST Action ES1205 - WG1 ThinkTank Meeting Engineered Nanomaterials in Landfills*, Dübendorf, Switzerland, 17-18 November 2014
 - Tosco T., **Bianco C.**, Sethi R. (2014) “Transport in porous media of iron nanoparticles for the remediation of contaminated aquifer systems” *Nanosafety Forum for Young Scientists*, Siracusa, Italy, 9-10 October 2014.
 - T. Tosco, **Bianco C.**, Sethi R. (2013) “Modelling field-scale injection of shear thinning slurries of microscale iron particles: coupled flow and transport in radial and 3D geometries” *2nd European Symposium on Water Technology and Management*, Leuven, 20-21 November 2013. pp. 92-98