

ORLANDO SANTORO

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Current Position

January 2022 – Now Assistant Professor of General and Inorganic Chemistry, University of Insubria,
Department of Biotechnology and Life Sciences, Varese - Italy

Academic Qualifications

2023 National Scientific qualification as associate professor for the disciplinary field of 03/B1 –
Principles of chemistry and inorganic systems

2023 National Scientific qualification as associate professor for the disciplinary field of 03/B2 –
Principles of chemistry for applied technologies

2016 PhD, School of Chemistry, University of St Andrews, United Kingdom

2011 MSc in Chemistry, Department of Chemistry, University of Salerno, Italy

2009 BSc in Chemistry, Department of Chemistry, University of Salerno, Italy

Academic Research Activity

October 2020 – December 2021 and February 2017 – January 2019 Post-doctoral research assistant,
Rennes Institute of Chemical Sciences, Université de Rennes 1, France (Prof. Jean-François Carpentier,
Sponsored by TOTAL Petrochemicals)

February 2019 – September 2020 Post-doctoral research assistant, Department of Chemistry and
Biochemistry, The University of Hull, United Kingdom (Prof. Carl Redshaw)

Teaching Activity

University of Insubria

Lecturer for the General and Inorganic Chemistry course (1st year BSc in Biotechnology, 56 h)

Lecturer for the Biomaterials course (1st year MSc in Biotechnology, 18 h)

The University of Hull

Laboratory demonstrator for the 3rd Year Research Projects (Organometallic Chemistry and Catalysis)

Training of MSc students and co-supervision of their research projects (with Prof. Carl Redshaw):

University of St Andrews

Academic Year 2014/15, Semester 1 - Delivery of Inorganic Chemistry tutorials

Academic Year 2013/14, Semester 2 - Laboratory demonstrator for the 3rd Year Research Project

Publications

- (1) "Inherently Antimicrobial P(MMA-ran-DMAEMA) Copolymers Sensitive to Photodynamic Therapy: A Double Bactericidal Effect for Active Wound Dressing" **O. Santoro**, M. C. Malacarne, F. Sarcone, L. Scapinello, S. Pragliola, E. Caruso, V. T. Orlandi, L. Izzo, *Int. J. Mol. Sci.* **2023**, *24*, 4340.
- (2) "Ring Opening Polymerization of Lactides and Lactones by Multimetallic Titanium Complexes Derived from the Acids Ph₂C(X)CO₂H (X = OH, NH₂)" X. Zhang, T. J. Prior, K. Chen, **O. Santoro**, C. Redshaw, *Catalysts* **2022**, *12*, 935.
- (3) "Comonomer-controlled synthesis of long-chain branched (LCB)-polyethylene" **O. Santoro**, L. Piola, K. Mc Cabe, O. Lhost, K. Den Dauw, A. Fernandez, A. Welle, L. Maron, J.-F. Carpentier, E. Kirillov, *Eur. Polym. J.* **2022** *177*, 111477
- (4) "Group 12 and 13 metal-alkenyl promoted generation of long-chain branching in metallocene-based polyethylene" **O. Santoro**, L. Piola, K. Mc Cabe, O. Lhost, K. Den Dauw, A. Fernandez, A. Welle, L. Maron, J.-F. Carpentier, E. Kirillov, *Eur. Polym. J.* **2022**, *173*, 111257.
- (5) "Meso-and Rac-[bis(3-phenyl-6-tert-butylinden-1-yl)dimethylsilyl] zirconium Dichloride: Precatalysts for the Production of Differentiated Polyethylene Products with Enhanced Properties" K. Giffin, V. Cirriez, **O. Santoro**, A. Welle, E. Kirillov, J.-F. Carpentier, *Polymers* **2022**, *14*, 2217.
- (6) "Recent Advances in RO(CO)P of Bio-Based Monomers" **O. Santoro**, L. Izzo, F. Della Monica, *Sustain. Chem.* **2022**, *3*, 259.
- (7) "Metalocalix[n]arenes in catalysis: A 13-year update" **O. Santoro**, C. Redshaw, *Coord. Chem. Rev.*, **2021**, *448*, 214173.
- (8) "Al-alkenyl-induced formation of long-chain branched polyethylene via coordinative tandem insertion and chain-transfer polymerization using (nBuCp)2ZrCl2/MAO systems: An experimental and theoretical study" **O. Santoro**, L. Piola, K. Mc Cabe, O. Lhost, K. Den Dauw, A. Vantomme, A. Welle, L. Maron, J.-F. Carpentier, E. Kirillov, *Eur. Polym. J.* **2021**, *54*, 110567.
- (9) "Scandium calix[n]arenes (n = 4, 6, 8): structural, cytotoxicity and ring opening polymerization studies" A. F. Al Alshamrani, **O. Santoro**, T. J. Prior, M. A. Alamri, G. J. Stasiuk, M. R. J. Elsegood, C. Redshaw, *Dalton Trans.* **2021**, *50*, 8302.
- (10) "Comparative assessment of marine weathering of ROP-derived biopolymers against conventional plastics" K. Rodgers, W. M. Mayes, **O. Santoro**, C. Redshaw, R. Mccumskay, D. R. Parsons, *Mar. Pollut. Bull.*, **2021**, *167*, 112272.
- (11) "Lithium calix[4]arenes: structural studies and use in the ring opening polymerization of cyclic esters" **O. Santoro**, M. R. J. Elsegood, S. J. Teat, T. Yamato, C. Redshaw, *RSC Adv.*, **2021**, *11*, 11304.
- (12) "Synthesis, characterisation and ROP catalytic evaluation of Cu(II) complexes bearing 2,2'-diphenylglycine-derived moieties" A.F. Al Alshamrani, **O. Santoro**, S. Ounsworth, T. J. Prior, G. J. Stasiuk, C. Redshaw, *Polyhedron*, **2021**, *195*, 114977.
- (13) "Rare-earth metal complexes derived from the acids Ph₂C(X)CO₂H (X = OH, NH₂): Structural and ring opening polymerization (ROP) studies" J. Collins, **O. Santoro**, T. J. Prior, K. Chen and C. Redshaw, *J. Mol. Struct.*, **2021**, *1224*, 129083.
- (14) "Long-Chain Branched Polyethylene via Coordinative Tandem Insertion and Chain-Transfer Polymerization Using rac-{EBTHI}ZrCl2/MAO/Al-alkenyl Combinations: An Experimental and

Theoretical Study” **O. Santoro**, L. Piola, K. Mc Cabe, O. Lhost, K. Den Dauw, A. Vantomme, A. Welle, L. Maron, J.-F. Carpentier, E. Kirillov, *Macromolecules*, **2020**, 53, 8847.

(15) “*INSIGHTS into the structures adopted by titanocalix[6 and 8]arenes and their use in the ring opening polymerization of cyclic esters*” **O. Santoro**, M. R. J. Elsegood, E. Bedwell, J. Pryce, C. Redshaw, *Dalton Trans.*, **2020**, 49, 11978.

(16) “*Synthesis of Biodegradable Polymers: A Review on the Use of Schiff-Base Metal Complexes as Catalysts for the Ring Opening Polymerization (ROP) of Cyclic Esters*” **O. Santoro**, X. Zhang, C. Redshaw, *Catalysts*, **2020**, 10, 800.

(17) “*Use of titanocalix[4]arenes in the ring opening polymerization of cyclic esters*” Ziyue Sun,^a Yanxia Zhao, **O. Santoro**, M. R. J. Elsegood, E. V. Bedwell, K. Zahra, A. Walton, C. Redshaw, *Catal. Sci. Tech.*, **2020**, 10, 1619.

(18) “*Use of titanium complexes bearing diphenolate or calix[n]arene ligands in α -olefin polymerization and the ROP of cyclic esters*” **O. Santoro**, C. Redshaw, *Catalysts*, **2020**, 10, 210.

(19) “*Synthesis and structures of mono- and di-nuclear aluminium and zinc complexes bearing α -diimine and related ligands, and their use in the ring opening polymerization of cyclic esters*”, X. Lin, Y. Zhao, S. Qiao, Z. Sun, **O. Santoro**, C. Redshaw, *Dalton Trans.* **2020**, 49, 1456.

(20) “*Synthesis, characterization and catalytic activity of stable [(NHC)H][ZnXY₂] (NHC = N-Heterocyclic carbene, X, Y = Cl, Br) species*”, **O. Santoro**, F. Nahra, D. B. Cordes, A. M. Z. Slawin, S. P. Nolan, C. S. J. Cazin, *J. Mol. Cat. A: Chem.*, **2016**, 423, 85.

(21) “*Generalization of the Copper to Late Transition Metal Transmetalation to Carbenes beyond N-Heterocyclic Carbenes*”, Y. D. Bidal, **O. Santoro**, M. Melaimi, D. B. Cordes, A. M. Z. Slawin, G. Bertrand, C. S. J. Cazin, *Chem. Eur. J.*, **2016**, 22, 9404.

(22) “*Homoleptic and heteroleptic bis-NHC Cu(I) complexes as carbene transfer reagents*”, **O. Santoro**, F. Lazreg, D. B. Cordes, A. M. Z. Slawin, C. S. J. Cazin, *Dalton Trans.*, **2016**, 45, 4970.

(23) “*N-heterocyclic carbene copper(I) catalysed N-methylation of amines using CO₂*”, **O. Santoro**, F. Lazreg, Y. Minenkow, L. Cavallo, C. S. J. Cazin, *Dalton Trans.*, **2015**, 44, 18138.

(24) “*A general synthetic route to [Cu(X)(NHC)] (NHC = N-heterocyclic carbene, X = Cl, Br, I) complexes*”, **O. Santoro**, A. Collado, A. M. Z. Slawin, S. P. Nolan, C. S. J. Cazin, *Chem. Commun.*, **2013**, 49, 10483.

(25) “*Asymmetric Hydrodimerization of Styrene by a Chiral Zirconium Complex Containing a Tetradentate [OSSO]-type Bis(phenolate) Ligand*”, N. Galdi, **O. Santoro**, L. Oliva, A. Proto, C. Capacchione, *Catal. Commun.*, **2011**, 12, 1113.

Patents

(1) “*Process for Preparing Propylene Polymers Having Long Chain Branches*” A. Welle, J.-F. Carpentier, E. Kirillov, L. Piola, **O. Santoro**, Patent WO2022029212A1 to Total Research and Technology Feluy.

(2) “*Process for Preparing Ethylene Polymers Having Long Chain Branches*” A. Welle, J.-F. Carpentier, E. Kirillov, L. Piola, **O. Santoro**, Patent WO2022029213A1 to Total Research and Technology Feluy.

Contributions to Conferences

Member of the scientific committee of the *Milan Polymer Days 2024 – University of Milan (June 2024)*

Oral Communications

(1) *Milan Polymer Days – University of Milan (June 2023)*

“Sustainable polymers via Controlled Radical Polymerization (CRP): synthetic and mechanistic aspects”

(2) *Milan Polymer Days – University of Milan (June 2022)*

“Biodegradable polylactones by Ti-catalyzed Ring Opening Polymerization (ROP) of cyclic esters”

(3) *Dalton Younger Members Event – University of Leeds (September 2015)* “N-Heterocyclic Carbene Copper(I) Catalysed N-methylation of amines using CO₂”

Posters

(1) *2nd EuCheMS Congress on Green and Sustainable Chemistry – University of Lisbon (October 2015)*

“N-Heterocyclic Carbene Copper(I) Catalysed N-methylation of amines using CO₂”

(2) *20th EuCheMS Conference on Organometallic Chemistry – University of St Andrews (Luglio 2013)*

“Copper-NHC complexes in synthesis”

Research Interests

My research activity is devoted to the design, synthesis and characterization of organometallic compounds and to their catalytic applications, particularly in CO₂ fixation reactions and in the production of polymeric material.

During my PhD at *University of St Andrews* I focused on the development of complexes of Cu(I) and Zn(II) bearing N-Heterocyclic carbene (NHC) ligands and on their use as catalysts for the N-methylation of amines using carbon dioxide as C-1 building block. Further, I have employed said Cu-based complexes as carbene-transfer agents towards other transition metals (Au, Pd, Rh, Ir and Ru) to synthesize a library of novel NHC-based compounds having potential catalytic applications.

My postdoctoral research activity at the *Université de Rennes 1*, in collaboration with *TotalEnergies* (ex *Total Petrochemicals*) involved the design of new catalytic systems to produce polyethylenes and polypropylenes displaying complex molecular architectures, in particular long-chain branches and cross-links.

As a postdoctoral fellow at the *University of Hull* I have worked on the development of novel catalysts for the synthesis of biodegradable polyesters derived from renewable sources. The project mainly focused on the use of multimetallic Ti-, Al- and Zn-based complexes with cyclic/macrocyclic ligands (calixarenes, Schiff bases). The biodegradation as well as the toxicity of the polymers have been investigated to evaluate their potential applications in medicinal/pharmaceutical fields.

My current research activity within the *University of Insubria* concerns the synthesis of sustainable elastomeric materials by Controlled Radical Polymerization. The project is co-funded by *Prometeon Tyre Group*.