

Curriculum Vitae

Dr. Elisa Borfecchia

PERSONAL INFORMATION

Family name, First name: Borfecchia, Elisa
Researcher unique identifier(s): ORCID: 0000-0001-8374-8329,
 Research ID: M-2568-2015
Date of birth: 12 January 1985
Nationality: Italian
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EDUCATION

01/01/2010 – 31/12/2012	PhD in Science and Technology of Materials and Nanosystems Disputation date: 22/01/2013 Department of Chemistry, University of Turin, Italy Title: <i>“Synchrotron radiation time and space resolved characterization of materials: a new frontier in Material Science”</i> . PhD Supervisor: Prof. Carlo Lamberti
01/10/2006 – 22/07/2009	Master in Physics of the Advanced Technologies (110/110 cum laude) Faculty of Physics, University of Turin, Italy Title: <i>“Characterization of metallorganic complexes investigated by pump and probe experiment in the ns and μs time delay regime”</i> .

CURRENT POSITION(S)

27/12/2018 – now	Assistant professor (<i>‘Ricercatore a tempo determinato, tipologia B’</i>) Department of Chemistry, University of Turin, Italy
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PREVIOUS POSITIONS

01/07/2018 – 26/12/2018	Marie Skłodowska-Curie Fellow Center for Materials Science and Nanotechnology (SMN), Chemistry Department, University of Oslo, Norway
01/07/2016 – 30/06/2018	Industrial Scientist R&D, Atomic Scale Analysis Department, Haldor Topsøe A/S, Denmark
01/10/2017 – 30/06/2018	Adjunct Professor , ‘Elements of Biochemistry – Physical Chemistry Module’ BSc Degree in Science of Sport Activities, University of Turin, Italy
01/07/2015 – 30/06/2016	Post-doctoral Fellow Department of Chemistry, University of Turin, Italy
07/01/2015 – 30/06/2015	Research Trainee National Institute for Materials Science and Technology (INSTM), Italy
01/01/2013 – 31/12/2014	Post-doctoral Fellow , Department of Chemistry, University of Turin, Italy

FELLOWSHIPS

01/07/2018 – 30/06/2020	Marie Skłodowska-Curie Individual Fellowship , call H2020-MSCA-IF-2017. Project title: <i>‘CASCADE-X - CO₂ to light olefins conversion by cascade reactions over bifunctional nanocatalysts: an ‘all X-ray’ approach’</i> . Host institution: University of Oslo (Chemistry Department), project supervisor: Prof. Unni Olsbye. EU funding: 196 K€/2 Yr.
01/07/2016 – 30/06/2018	Industrial Post-Doc Fellowship , Innovation Fund Denmark, Denmark.

01/07/2015 – 30/06/2016	<p>Project: 'SYNCHRO-M2M: Synchrotron-enhanced characterization of Cu-based heterogeneous catalysts for the direct conversion of methane to methanol'. Partners: Company: Haldor Topsøe A/S (Denmark), Research Institution: University of Turin, (Italy). Funding: ca. 100 K€/2 Yr (fellow salary, project-related costs and travel expenses)</p> <p>Italian Ministerial Post-Doc Fellowship ('Assegno Co-finanziato MIUR') to fund research at the Department of Chemistry, University of Turin, Italy. Project: 'Characterization of advanced materials using synchrotron radiation techniques'. Funding: 20 K€/1 Yr (fellow salary).</p>
01/01/2010 – 22/01/2013	<p>PhD fellowship, National Institute for Materials Science and Technology, Project: 'Synchrotron radiation time and space resolved characterization of materials: a new frontier in material science'. Funding: 25 K€/3 Yr (fellow salary).</p>

PRIZES AND AWARDS

2019	<p>"2019 ESRF Young Scientist Award" (assigned every year by the Users Organisation for outstanding work done by an ESRF user at the ESRF facilities) for the impressive results on selective catalysis that Dr. Borfecchia obtained with extensive use of X-ray spectroscopy.</p>
2018	<p>"2018 Dale Sayer Outstanding Young Scientist Award for the Applications of XAFS" (assigned every three years by the International X-ray Absorption Society, iXAS) in recognition of Dr Borfecchia's application of XAFS studying the reactivity of metals sites in catalysts.</p> <p>Prize "L'ORÉAL Italia For Women in Science", edition 2017/2018 Letter of appreciation from the Evaluation Committee for being selected among the 10 top applications over ca. 450 applications received in all the fields of Life, Physical, Formal Sciences and Engineering Science.</p>
2010	<p>Award "Premio Optime" from the Italian Industrial Union for the best MSc Thesis in Physics (Academic Year 2009/2010).</p>

Italian National Scientific Qualification (ASN)

2018 – 2027	<p>After evaluation of her scientific and academic CV by a national review panel, Dr. Borfecchia has been certified as qualified for the function of Associate Professor from 05/04/2018 to 05/04/2027 in the following scientific sectors:</p> <ul style="list-style-type: none"> • Physical Chemistry (Scientific Sector 03/A2) • Inorganic Chemistry (Scientific Sector 03/B1) • Chemical Fundamentals of Technologies (Scientific Sector 03/B2)
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SUPERVISION OF MASTER and PhD STUDENTS

2013 – now	<p>Supervisor for:</p> <ul style="list-style-type: none"> • 1 Master Student, Master Degree in Materials Science, University of Turin, Italy. <p>Co-supervisor/mentor for:</p> <ul style="list-style-type: none"> • 5 Master Students, Departments of Physics, Chemistry, and Drug Science and Technology, University of Turin, Italy. • 1 Master Student in Chemistry, Department of Chemistry, University of Oslo, Norway. • 5 PhD students, PhD Course in Chemistry and Materials Science, University of Turin, Italy (in cotutelle with Southern Federal University, Rostov-on-Don, Russia). • 1 Visiting PhD student (University of Aarhus, Denmark)
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[All the co-supervised Master and PhD thesis projects are strongly focused on the use of X-ray spectroscopy in the characterization of heterogeneous catalysts, see Annex IV for a detailed list]

TEACHING ACTIVITIES

A.A. 2019-2020	<ul style="list-style-type: none"> • Short course “Synchrotron-based X-ray spectroscopy: Principles, methods and applications to metal ions in porous frameworks”, Ph.D. School in Industrial Chemistry, University of Milan (0.5 CFU, 4 h frontal lesson), 07-06/02/2020. • Course: X-ray spectroscopy for the characterization of molecules and materials (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy (4 CFU – 24 h frontal lesson + 16 h laboratory). • Course: Advanced Crystallography – Spectroscopy Module (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy and MaMaSELF+ - Master in Materials Science Exploring Large Scale Facilities (3 CFU – 24 h frontal lesson). • Summer school 2019, MaMaSELF+ - Master in Materials Science Exploring Large scale Facilities, Lecture: XAFS (1 CFU - 8 h frontal lesson), Montpellier, September 10, 2019.
A.A. 2018-2019	<ul style="list-style-type: none"> • Course: Materials Today - Module: Metal Organic Frameworks (SSD: CHIM/02), BSc Degree in Materials Science, University of Turin, Italy (8 h frontal lessons, 1 CFU). • Course: Chimica Fisica II, Esercitazioni (SSD: CHIM/02), BSc Degree in Materials Science, University of Turin, Italy (12 h training, 1 CFU)
01/10/2014 – 30/06/2018	<ul style="list-style-type: none"> • Adjunct Professor, ‘<i>Elements of Biochemistry – Physical Chemistry Module</i>’, BSc Degree in Science of Sport Activities, University of Turin, Italy (16 h frontal lessons, approx. 130 students per Academic Year)
01/10/2015 – 30/09/2016	<ul style="list-style-type: none"> • Adjunct Professor, ‘<i>Realignment Course in Physics and Chemistry</i>’, BSc Degree in Science of Sport Activities, University of Turin, Italy (16 h frontal lessons, ca. 180 students)
From 2012	<ul style="list-style-type: none"> • Several didactic seminars given at the Departments of Physics and Chemistry of the University of Torino for the students of the Master degree courses in Physics, Materials Science and MaMaSELF European Master about properties and applications of synchrotron radiation.

COMMISSIONS OF TRUST

From 2014	<ul style="list-style-type: none"> • Reviewer for the following international (ISI) journals: <i>Nature, Nature Chem., Nature Catal., Nature Comm., J. Am. Chem. Soc., Angew. Chem., -Int. Edit., ACS Catal., J. Catal., Appl. Catal. B, Catal. Sci. & Technol.; J. Phys. Chem. C, Phys. Chem. Chem. Phys.; Catalysts, React. Kinet. Mech. Cat., Appl. Surf. Sci., Mater. Sci. Eng. B, Rad. Phys. Chem., J. Environ. Sci.</i>
2020	<ul style="list-style-type: none"> • Member of the Recruitment Advisory Board for MSCA COFUND PhD Programme INNOVAXN at the European Synchrotron Radiation Facility (ESRF) and Institute Laue Langevin (ILL), Grenoble (France).
From 2019	<ul style="list-style-type: none"> • Assistant coordinator for the MaMaSELF+ (Master in Materials Science Exploring Large Scale Facilities) Erasmus Mundus program at UniTO and member of the students’ selection panel.
2019-2021	<ul style="list-style-type: none"> • Member of the Proposal Review Committee of the Photon Science Division (Paul Scherrer Institute, PSI, Switzerland); HardXAS sub-committee (beamlines: MicroXAS, SuperXAS, Phoenix).
From 2019	<ul style="list-style-type: none"> • Project Evaluator, ACS Petroleum Research Fund, American Chemical Society.
2019	<ul style="list-style-type: none"> • Proposal Evaluator, 3 proposals for synchrotron experiments submitted at the Stanford Synchrotron Radiation Lightsource (SSRL), California, US (09/2019).
2018	<ul style="list-style-type: none"> • Proposal Evaluator, Swiss Norwegian Beamlines (SNBL), ESRF, France.

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| 2016 | <ul style="list-style-type: none"> • Project Evaluator, Swiss National Science Foundation (SNSF), Switzerland. • Reviewer for the book: <i>'XAS and XES; theory and applications'</i>, J. A. van Bokhoven, C. Lamberti Eds., John Wiley & Sons (2016), ISBN: 978-1-118-84423. |
| 2015 | |

RESEARCH PROJECTS

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|-------------------------|--|
| 01/01/2020 - 31/12/2026 | <ul style="list-style-type: none"> • Project CUBE <i>"Copper Based catalysts for selective C-H activation"</i>, ERC-Synergy. <u>Role: Participant</u>; PI (UniTO unit): Prof. S. Bordiga (budget UniTO unit: 2 100 000 €). |
| 05/06/2019 - 04/06/2022 | <ul style="list-style-type: none"> • Project MOSCATo <i>"Cutting-edge X-ray methods and models for the understanding of surface site reactivity in heterogeneous catalysts and sensors"</i>, PRIN-2017, <u>Role: Participant</u>; PI (UniTO coordinator unit): Prof. G. Ricchiardi (budget UniTO unit: 209 406 €). |
| 01/05/2019 - 30/04/2023 | <ul style="list-style-type: none"> • Project COZMOS <i>"Efficient CO₂ conversion over multisite Zeolite-Metal nanocatalysts to fuels and Olefins"</i>, H2020 RIA, H2020-LC-SC3-2018-NZE-CC. <u>Role: Participant</u>; PI (UniTO unit): Prof. S. Bordiga (overall budget: 4 752 386 €). |
| 01/07/2018 - 27/12/2018 | <ul style="list-style-type: none"> • Project CASCADE-X <i>"CO₂ to light olefins conversion by cascade reactions over bifunctional nanocatalysts: an 'all X-ray' approach"</i>, Marie Skłodowska-Curie Action, Individual Fellow (MSCA-IF), call H2020-MSCA-IF-2017. Host institution: Center for Materials Science and Nanotechnology (SMN) and Chemistry Dept., University of Oslo (Norway); supervisor: Prof. Unni Olsbye. <u>Role: PI (funding: 196 400 €/2 years)</u>. |
| 01/07/2016 - 30/06/2018 | <ul style="list-style-type: none"> • Project SYNCHRO-M2M <i>"Synchrotron-enhanced characterization of Cu-based heterogeneous catalysts for the direct conversion of methane to methanol"</i>, project n. 5190-00018B, Call "Industrial Researcher 07-03-2016, funded by Innovation Fund Denmark and based on the collaboration between UniTO and Haldor Topsøe A/S (https://innovationsfonden.dk/en/investment/industrial-researcher). <u>Role: PI (funding: 102 000 €/2 years)</u>. |

Participation to Research Projects during PhD and Post-docs

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|-----------|---|
| 2016 | <ul style="list-style-type: none"> • Project NANO-X <i>"X-ray nanolithography for oxides"</i>, Progetti di Ricerca Compagnia di San Paolo-Progetto di Ateneo. <u>Role: Participant</u>; PI: Dr. M. Truccato (budget: 98 000 €). |
| 2012-2016 | <ul style="list-style-type: none"> • Research contract with Haldor Topsøe A/S, <i>"Structure and reactivity of single- and multiple-sites in zeolitic heterogeneous catalysts"</i>. <u>Role: Participant</u>, contract responsible: Prof. S. Bordiga e Prof. C. Lamberti (funding 230 000 €). |
| 2014-2018 | <ul style="list-style-type: none"> • "Mega Grant" of the Russian Federation n. 14.Y26.31.0001 supporting the <i>"Smart Materials Research Center"</i> (Southern Federal University, Russia). General director: Prof. A. V. Soldatov; Scientific director: Prof. C. Lamberti (finanziamento > 1 000 000 €). <u>Role: participant</u> (co-supervisor of 4 PhD students in co-tutelle with Southern Federal University; <i>"Visiting Scientist"</i> at the <i>"Smart Materials Research Center"</i> from 26/09/2015 to 09/10/2015 for research and networking activities related to the project). |
| 2012-2013 | <ul style="list-style-type: none"> • Project ORTO11RRT5 <i>"Advances in nanostructured materials and interfaces for key technologies"</i>, Progetti di Ricerca Compagnia di San Paolo-Progetto di Ateneo. <u>Role: Participant</u>; PI: Prof. S. Bordiga (funding: 1 000 988 €). |

MAJOR COLLABORATIONS

Collaborations with International Academic and Research Institutions

- University of Oslo and Industrial Catalysis Science and Innovation Centre, iCSI (Norway), Prof. U. Olsbye, Prof. S. Svelle; Host institution for previous MSCA-IF project (> 10 common publications).
- Southern Federal University and International Research Center "Smart Materials" (Russian Federation), Prof. A. V. Soldatov (co-supervision of 4 PhD students in co-tutelle, > 10 common publications);

- [Massachusetts Institute of Technology, MIT](#) (Boston, US), Prof. M. Dinca (4 common publications);
- [University of Warwick](#) (UK), Prof. P. J. Sadler (4 common publications);
- [Elettra Synchrotron](#) (Italy), Dr. P. Torelli, Dr. L. Braglia (beamline APE-HE), partner for the ongoing PRIN-2017 MOSCATo project.
- [European Synchrotron Radiation Facility, ESRF](#) (France), Dr. K. A. Lomachenko, Dr. G. Agostini (beamline BM23/ID24), Dr. A. Longo (beamline BM26), Dr. P. Glatzel (beamline ID26); Dr. M. Wulff (beamline ID09B), Dr. G. Martinez Criado (beamline ID16NA) (in total, > 20 common publications).

Collaboration with National and International Companies

- [Umicore Denmark ApS, Automotive Catalysts](#) (Denmark), Dr. T.V.W. Janssens (8 common publications).
- [Haldor Topsøe A/S](#) (Denmark), Dr. P. Beato, Dr. H. Falsig, Dr. L. Lundegaard, A. Puig-Molina (>10 common publications, employed in the company R&D during the previous Industrial Researcher project);
- [SINTEF](#) (Norway), Dr. B. Arstad (> 10 common publications);
- [Chimet SpA](#) (Italy), Dr. R. Pellegrini (1 common publication).

RESEARCH EXPERIENCE AND PRINCIPAL INTERESTS

Dr. Borfecchia has strong background in physical chemistry/material science and a consolidated experience on the use of **X-ray spectroscopy to characterize nanomaterials**. After a PhD project centred on data acquisition and analysis protocols for cutting-edge time- and space-resolved synchrotron experiments, her research interests become focused on **in situ/operando synchrotron-based X-ray absorption and emission spectroscopy**, combined with laboratory-based techniques (mostly FTIR, UV-Vis-NIR, EPR) to unravel the local structural and electronic properties of transition metal centres in heterogeneous catalysts. Key investigated systems/processes include Cu-exchanged zeolites for deNO_x applications and partial selective oxidation of methane to methanol, redox-active metal sites in metal organic frameworks, combined catalytic systems for CO₂ valorisation. She is also involved in **developing innovative experimental setups** (e.g., ambient pressure NEXAFS, quasi-simultaneous multi-technique collection) **and data analysis methods** (e.g., multivariate/statistical analysis, Machine Learning, EXAFS Wavelet transform) for X-ray spectroscopy.

PUBLICATIONS

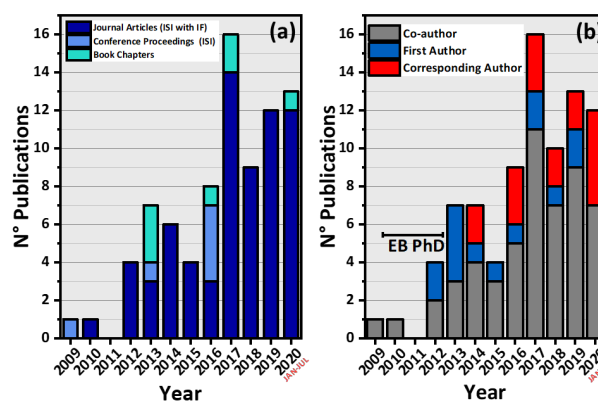
Publication summary

- **68** peer-reviewed articles on international (ISI) journals;
- **6** peer-reviewed conference proceedings;
- **8** peer-reviewed book chapters;
- **7** short papers on the ESRF Highlights;
- **2** on-line “ESRF Spotlights” articles.

Bibliometric Indexes

ISI WoS ([Google Scholar](#)), updated on 06/08/2020

Sum of Times Cited	1977 (2461)
Average Citations per Item	25.35
h-index	23 (25)



Bar plot presenting the time evolution of Dr. Borfecchia's publication track record (2009 - July 2020 period), specifying (a) type of publications and (b) role in the published works. For 2020, 5 additional papers are currently submitted/under revision.

Ten selected publications in the last five years

1. Martini, A.; Signorile, M.; Negri, C.; Kvande, K.; Lomachenko, K.A.; Svelle, S.; Beato, P.; Berlier, G.; **Borfecchia, E.***; Bordiga, S., EXAFS wavelet transform analysis of Cu-MOR zeolites for the direct methane to methanol conversion, *Phys. Chem. Chem. Phys.* **2020**, in press, doi: 10.1039/D0CP01257B.
2. **Borfecchia, E.***; Negri, C.; Lomachenko, K. A.; Lamberti, C.; Janssens, T. V. W.; Berlier, G., Temperature-dependent dynamics of NH₃-derived Cu species in the Cu-CHA SCR catalyst. *React. Chem. Eng.* **2019**, *4*, 1067-1080.
3. Pappas, D. K.; Martini, A.; Dyballa, M.; Kvande, K.; Teketel, S.; Lomachenko, K. A.; Baran, R.; Glatzel, P.; Arstad, B.; Berlier, G.; Lamberti, C.; Bordiga, S.; Olsbye, U.; Svelle, S.; Beato, P.; **Borfecchia, E.***, The nuclearity of the active site for methane to methanol conversion in Cu-mordenite: a quantitative assessment, *J. Am. Chem. Soc.*, **2018**, *140*, 45, 15270-15278.

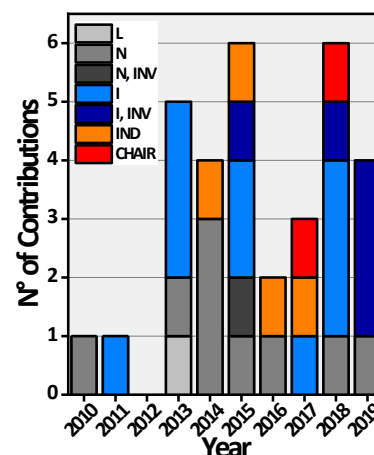
- Borfecchia, E.**; Beato, P.; Svelle, S.; Olsbye, U.; Lamberti, C.; Bordiga, S., Cu-CHA – a model system for applied selective redox catalysis, *Chem. Soc. Rev.*, **2018**, *47*, 8097-8133.
- Pappas, D. K.; **Borfecchia, E.***; Dyballa, M.; Pankin, I.; Lomachenko, K. A.; Martini, A.; Signorile, M.; Teketel, S.; Arstad, B.; Berlier, G.; Lamberti, C.; Bordiga, S.; Olsbye, U.; Lillerud, K. P.; Svelle, S.; Beato, P., Methane to methanol: structure-activity relationships for Cu-CHA. *J. Am. Chem. Soc.* **2017**, *139*, 14961-14975. • Featured in the ESRF HL 2017.
- Martini, A.; **Borfecchia, E.***; Lomachenko, K. A.; Pankin, I.; Negri, C.; Berlier, G.; Beato, P.; Falsig, H.; Bordiga, S.; Lamberti, C., Composition-driven Cu-speciation and reducibility in Cu-CHA zeolite catalysts: a multivariate XAS/FTIR approach to complexity. *Chem. Sci.* **2017**, *8*, 6836-6851.
- Andersen, C. W.; **Borfecchia, E.**; Bremholm, M.; Jørgensen, M.; Vennestrøm, P.; Lamberti, C.; Lundegaard, L.; Brummerstedt Iversen, B., Redox driven migration of Cu ions in Cu-CHA highlighted by in situ PXRD/XANES. *Angew. Chem. Int. Edit.*, **2017**, *56*, 10367-10372.
- Tulchinsky, Y.; Hendon, C. H.; Lomachenko, K. A.; **Borfecchia, E.**; Melot, B. C.; Hudson, M. R.; Tarver, J. D.; Korzynski, M. D.; Stubbs, A. W.; Kagan, J. J.; Lamberti, C.; Brown, C. M.; Dinca, M., Reversible Capture and Release of Cl₂ and Br₂ with a Redox-Active Metal-Organic Framework. *J. Am. Chem. Soc.* **2017**, *139*, 5992-5997. • Featured in the ESRF HL 2017.
- Lomachenko, K. A.; **Borfecchia, E.***; Negri, C.; Berlier, G.; Lamberti, C.; Beato, P.; Falsig, H.; Bordiga, S., The Cu-CHA deNO_x Catalyst in Action: Temperature-Dependent NH₃-Assisted Selective Catalytic Reduction Monitored by Operando XAS and XES. *J. Am. Chem. Soc.* **2016**, *138*, 12025-12028. • Featured in the ESRF HL 2016. • Selected for the Virtual issue *Application of Modern X-ray Spectroscopy in Chemistry – Beyond Studying the Oxidation State*, *Chem. Mater.* **2017**, *29*, 7051-7053.
- Tyrsted, C.; **Borfecchia, E.***; Berlier, G.; Lomachenko, K. A.; Lamberti, C.; Bordiga, S.; Vennestrom, P. N. R.; Janssens, T. V. W.; Falsig, H.; Beato, P.; Puig-Molina, A., Nitrate-nitrite equilibrium in the reaction of NO with a Cu-CHA catalyst for NH₃-SCR. *Catal. Sci. Technol.* **2016**, *6*, 8314-8324.

[See Annex I for the complete publications list by Dr. E. Borfecchia]

CONTRIBUTIONS TO CONFERENCES and OTHER SCIENTIFIC EVENTS

- **Presenting Author for:**
 - 5 invited oral contributions to International Conferences
 - 1 invited oral contribution to National Conferences
 - 6 oral contributions to International Conferences
 - 5 oral contributions to National/Local Conferences
 - 9 poster contributions to National & International Conferences
 - 4 invited talks to Industrial Workshops
 - 1 invited talk to Popular Science events
- **Author for more than 80 oral and poster contributions**
- **Chair for:**
 - 1 short section of International Conference
 - 1 local Scientific Congress
- **Organizer of:**
 - 1 local Scientific Congress
 - 1 International School

[See Annex II for the complete list of oral contributions presented]



Bar plot presenting the time evolution of Dr. Borfecchia's contributions to National and International scientific events (2009-2019 period). Key: L: Local event; N = National Event; I = International Event; IND = Industrial Event. INV = Invited contribution; CHAIR.

EXPERIMENTS AT LARGE SCALE SYNCHROTRON FACILITIES

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|-----------|---|
| From 2009 | Co-proposer and/or member of the experimental team for more than 50 experiments performed after acceptance of a peer-reviewed experimental proposal at international synchrotron sources, mostly at the ESRF (France) but also at the APS (US), MAX II/MAX IV (Sweden), Soleil (France) and Elettra (Italy). |
| From 2016 | Main proposer and leader of the research expedition for 7 experiments at international synchrotron sources. |

[See Annex III for a complete list of experiments at synchrotron sources proposed and performed]

ANNEXES

ANNEX I - COMPLETE LIST OF PUBLICATIONS

* = Articles where Dr. E. Borfecchia acted as corresponding author

[REV] = Review articles

Articles published on international (ISI) journals with IF

- A1. Martini, A.; Signorile, M.; Negri, C.; Kvande, K.; Lomachenko, K.A.; Svelle, S.; Beato, P.; Berlier, G.; **Borfecchia, E.***; Bordiga, S., EXAFS wavelet transform analysis of Cu-MOR zeolites for the direct methane to methanol conversion, *Phys. Chem. Chem. Phys.* **2020**, in press, doi: 10.1039/DOCP01257B.
- A2. Pappas, D.K.; Kvande, K.; Kalyva, M.; Dyballa, M.; Lomachenko, K.A.; Arstad, B.; **Borfecchia, E.***; Bordiga, S.; Olsbye, U.; Beato, P.; Svelle, S., Influence of Cu-speciation in mordenite on direct methane to methanol conversion: Multi-technique characterization and comparison with NH₃ selective catalytic reduction of NO_x. *Catal. Today* **2020**, in press, doi: 10.1016/j.cattod.2020.06.050.
- A3. Kømurcu, M.; Lazzarini, A.; Kaur, G.; **Borfecchia, E.**; Øien-Ødegaard, S.; Gianolio, D.; Bordiga, S.; Lillerud, K. P.; Olsbye, U., Co-catalyst free ethene dimerization over Zr-based metal-organic framework (UiO-67) functionalized with Ni and bipyridine. *Catal. Today* **2020**, in press, doi: 10.1016/j.cattod.2020.03.038.
- A4. [REV] Martini, A.; **Borfecchia, E.***; Spectral Decomposition of X-ray Absorption Spectroscopy Datasets: Methods and Applications, *Crystals* **2020**, *10*, 664.
- A5. Ahoba-Sam, C.; **Borfecchia, E.**; Lazzarini, A.; Bugaev, A.; Isah, A.A.; Taoufik, M.; Bordiga, S.; Olsbye, U., On the conversion of CO₂ to value added products over composite PdZn and H-ZSM-5 catalysts: excess Zn over Pd, a compromise or a penalty? *Catal. Sci. Technol.* **2020**, *10*, 4373.
- A6. [REV] Kvande, K.; Pappas, D. K.; **Borfecchia, E.**; Lomachenko, K. A. (2020), Advanced X-ray absorption spectroscopy analysis to determine structure-activity relationships for Cu-zeolites in the direct conversion of methane to methanol. *ChemCatChem.* **2020**, *12*, 2385.
- A7. Buono, C.; Martini, A.; Pankin, I. A.; Pappas, D. K.; Negri, C.; Kvande, K.; Lomachenko, K. A.; **Borfecchia, E.***, Local structure of Cu(I) ions in the MOR zeolite: A DFT-assisted XAS study, *Rad. Phys. Chem.* **2020**, *175*, 108111.
- A8. Martini, M.; Pankin, I. A.; Marsicano, A.; Lomachenko, K. A.; **Borfecchia, E.**, Wavelet analysis of a Cu-oxo zeolite EXAFS simulated spectrum. *Rad. Phys. Chem.* **2020**, *175*, 108333.
- A9. Pankin, I. A.; **Borfecchia, E.**; Martini, A.; Lomachenko, K. A.; Lamberti, C.; Soldatov, A. V., DFT-assisted XANES simulations to discriminate different monomeric Cu^{II} species in CHA catalysts. *Rad. Phys. Chem.* **2020**, *175*, 108510.
- A10. Pankin, I. A.; Martini, A.; Lomachenko, K. A.; Soldatov, A. V.; Bordiga, S.; **Borfecchia, E.*** Identifying Cu-oxo species in Cu-zeolites by XAS: a theoretical survey by DFT-assisted XANES simulation and EXAFS wavelet transform. *Catal. Today* **2020**, *345*, 125-135.
- A11. Kvande, K.; Pappas, D. K.; Dyballa, M.; Buono, C.; Signorile, M.; **Borfecchia, E.**; Lomachenko, K. A.; Arstad, B.; Bordiga, S.; Berlier, G.; Olsbye, U.; Beato, P.; Svelle, S., Comparing the Nature of Active Sites in Cu-loaded SAPO-34 and SSZ-13 for the Direct Conversion of Methane to Methanol, *Catalysts* **2020**, *10*, 191.
- A12. Priola, E.; Volpi, G.; Rabezzana, R.; **Borfecchia, E.**; Garino, C.; Benzi, P.; Martini, A.; Operti, L.; Diana, E., Bridging solution and solid-State chemistry of dicyanoaurate: The case study of Zn-Au nucleation units, *Inorg. Chem.* **2020**, *59*, 203-213.
- A13. Dyballa, M.; Thorshaug, K.; Pappas, D. K.; **Borfecchia, E.**; Kvande, K.; Bordiga, S.; Berlier, G.; Lazzarini, A.; Olsbye, U.; Beato, P.; Svelle, S.; Arstad, B., Zeolite surface methoxy groups as key intermediates in the stepwise conversion of methane to methanol. *ChemCatChem* **2019**, *11*, 5022-5026.
- A14. Zhang, X.; Ponte, F.; **Borfecchia, E.**, Martini, M.; Sanchez-Cano, C.; Sicilia, E.; Sadler, P. J., Glutathione activation of an organometallic half-sandwich anticancer drug candidate by ligand attack. *Chem. Commun.* **2019**, *55*, 14602-14605.
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- O8. *Redox-active MOF for reversible capture and release of halogens*, published on-line on 10/05/17: <http://www.esrf.eu/home/news/spotlight/content-news/spotlight/spotlight286.html>
- O9. *Oxygen doping level tuning in the Bi-2212 superconductor by X-ray nano-beam irradiation*, published on-line on 26/06/2014: <http://www.esrf.eu/home/news/spotlight/content-news/spotlight/spotlight210.html>

ANNEX II. COMPLETE LIST OF ORAL CONTRIBUTIONS PRESENTED TO CONFERENCES and OTHER SCIENTIFIC EVENTS

Invited Talks at International (I) and National (N) Conferences/Schools

- [I, INV] Invited Keynote**, Borfecchia E.; *X-ray absorption spectroscopy to track structural and chemical dynamics of metal ions in nanoporous frameworks*. Fifth Meeting of the Italian (AIC) and Spanish Crystallographic (GE3C) Associations (MISCA V), Naples (Italy), September 4-7, 2019.
- [I, INV] Invited Keynote**, Borfecchia E.; *Understanding selective redox chemistry in Cu-zeolites: a synchrotron-enhanced multi-technique perspective*. Jointly Meeting of the Italian Zeolite Association (AIZ), Czech-Italian-Spanish Conference (CIS), Italian Interdivisional Catalysis Group (GIC), Amantea (Italy), June 11-14, 2019.
- [I, INV] Invited Talk**, “Hard X-ray spectroscopy to understand selective redox catalysis over Cu-zeolites”, ESRF User Meeting 2019, EPN Science Campus, Grenoble (France), February 4-6, 2019.
- [I, INV] Invited Talk**, “Case Study: Synchrotron-based X-ray spectroscopy to determine Cu-speciation in zeolite-based catalysts”, 3rd KAUST Research Conference: New Challenges in Heterogeneous Catalysis”, KAUST Catalysis Centre, Thuwal (Saudi Arabia), January 29-31, 2018.
- [I, INV] Invited Keynote Lecture**, “Synchrotron X-ray methods to follow the chemistry of coordination compounds: applications at different timescales”, The International Joint School “Smart Nanomaterials

and X-ray Optics" (IWSN2015) School, Rostov-on-Don (Russia), September 27-30, 2015.

6. **[N, INV] Invited Keynote Lecture**, "Tracking structural and electronic properties of coordination compounds: the role of synchrotron radiation", XLIV Annual Meeting of the AIC, Vercelli (Italy), September 14-18, 2015.

Oral contributions presented to International (I) Conferences/Schools

1. **[I, O] Borfecchia, E.**; Martini, A.; Pankin, I. A.; Lomachenko, K. A.; Berlier, G.; Beato P.; Pappas, D. K.; Dyballa, M.; Svelle, S.; Lamberti, C.; Bordiga, S., "XAS reveals structure-activity relationships for the methane to methanol conversion over Cu-SSZ-13 zeolites". 17th International Conference on X-ray Absorption Fine Structure (XAFS 2018), Kraków, Poland, July 22-27, 2018.
2. **[I, O] Borfecchia, E.**; Martini, A.; Lomachenko, K. A.; Beato, P.; Svelle, S.; Olsbye, U.; Pappas, D. K.; M. Dyballa, M.; Berlier, G.; Lamberti, C.; Bordiga, S., "Structural dynamics of Cu ions in zeolite catalysts from multivariate analysis of time-resolved XAS". Time, Work and Function Workshop 2018, University of Oslo, Oslo (Norway), June 13-15, 2018
3. **[I, O] Borfecchia, E.**; Martini, A.; Lomachenko, K. A.; Pappas, D. K.; Berlier, G.; Svelle, S.; Beato, P.; Lamberti, C.; Bordiga, S., "Composition-driven reducibility in Cu-CHA: potential of XAS MCR analysis and implications for methane to methanol conversion". 6th International Congress on Operando Spectroscopy (Operando VI), Estepona, Málaga (Spain), April 15-19, 2018.
4. **[I, O] Borfecchia, E.**; Martini, A.; Lomachenko, K. A.; Negri, C.; Berlier, G.; Beato, P.; Falsig, H.; Lamberti, C.; Bordiga, S., "Tracking by XAS the birth of Cu-active sites in zeolite-based catalysts: composition effects on Cu-speciation and reducibility in Cu-CHA". European Congress on Catalysis, EUROPACAT 2017, Florence (Italy), August 27-31, 2017.
5. **[I, O] Borfecchia, E.**; Øien, S.; Agostini, G.; Svelle, S.; Lomachenko, K. A.; Mino, L.; Gallo, E.; Bordiga, S.; Olsbye, U.; Lillerud, K.P.; Lamberti, C., "A XAS study of the local environment and reactivity of Pt-sites in functionalized UiO-67 MOFs", 16th International Conference on X-ray Absorption Fine Structure XAFS16, Karlsruhe (Germany), August 23-28, 2015
6. **[I, O] Borfecchia, E.**; Garino, C.; Gianolio, D.; Salassa, L.; Gobetto, R.; Lamberti, C. "Monitoring excited state dynamics in cis-[Ru(bpy)₂(py)₂]²⁺ by ultrafast synchrotron techniques", E-MRS 2013 Spring Meeting, Strasbourg (France), May 27-30, 2013.

Oral contributions presented to National (N) and Local (L) Conferences/Schools

1. **[N, O] Borfecchia E.**; Shedding Light on Cu-Zeolite Catalysts by X-Ray Absorption Spectroscopy: Novel Challenges and Opportunities. XLVII Congresso Nazionale di Chimica Fisica, Rome (Italy), July, 1-4, 2019.
2. **[N, O] Borfecchia, E.**; Pappas, D. K.; Dyballa, M.; Martini, A.; Lomachenko, K. A.; Berlier, G.; Beato, P.; Lamberti, C.; Bordiga, S.; Olsbye, U.; Svelle, S., "Methane to methanol conversion over Cu-zeolites – the XAS view", Norwegian Catalysis Symposium, Lillestrøm (Norway), October 16-17, 2018.
3. **[N, O] Borfecchia, E.**; Lomachenko, K. A.; Negri, C.; Beato, P.; Falsig, H.; Tyrsted, C.; Janssens, T.V.W.; Puig-Molina, A.; Vennestrøm, P.N.R.; Berlier, G.; Bordiga, S.; Lamberti, C., "The Cu-CHA deNO_x catalyst 'in action': understanding NH₃-SCR catalysis by in situ and operando XAS and XES", XXIV Congress of the Italian Synchrotron Radiation Society, Bari (Italy), September 21-23, 2016
4. **[N, O] Borfecchia, E.**; Braglia, L.; Lazzarini, A.; Lomachenko, K. A.; Mino, L.; Øien, S.; Agostini, G.; Gallo, E.; Groppo, E.; Bordiga, S.; Lillerud, K. P.; Lamberti, C., "Reactive Pt-sites in functionalized UiO-67-Pt MOFs: the XAS view", XXIII Meeting of the Italian Synchrotron Radiation Society, Trento (Italy), July 8-10, 2015
5. **[L, O] Borfecchia, E.** "Excited state dynamics and photochemistry of transition metal complexes. Part 2: insight from synchrotron ultrafast X-ray techniques", NIS colloquium "Time and space resolved techniques with SR beams", Torino (Italy), January 08, 2013.

Poster contributions presented to International (I) and National (N) Conferences/Schools

1. **[I, P] Borfecchia, E.**; Mino, L.; Groppo, C.; Castelli, D.; Martinez-Criado, G.; Spiess, R.; Lamberti, C. Mapping iron oxidation state in zoned micro-crystals: a micro-XANES study, 16th International Conference on X-ray Absorption Fine Structure XAFS16, Karlsruhe, Germany, August 23-28, 2015.

2. **[N, P] Borfecchia, E.**; Mino, L.; Lomachenko, K. A.; Chiari, E.; Agostini, G.; Øien, S.; Shearer, G. C.; Svellec, S.; Lillerud, K. P.; Bordiga, S.; Lamberti, C. *Probing the local environment of Pt-sites in functionalized UiO-67 MOFs*, 2nd Joint AIC-SILS conference, Florence (Italy), September 15-18, 2014.
3. **[N, P] Borfecchia, E.**; Giordanino, F.; Lomachenko, K. A.; Beato, P.; Bordiga, S.; Lamberti, C. *Nature and reactivity of Cu-sites in the Cu-SSZ-13 SCR catalyst: a combined XAS/XES/FT-IR investigation*, 2nd Joint AIC-SILS conference, Florence (Italy), September, 15-18, 2014.
4. **[N, P] Borfecchia, E.**; Garino, C.; Salassa, L.; Gobetto, R.; Lamberti, C. *Probing the photochemistry of cis-[Ru(bpy)₂(py)₂]²⁺ on the ultrafast scale: results from synchrotron techniques and perspectives with XFELs*, SILS Workshop: Scientific Opportunities at the European X-FEL, Bologna, Italy, July, 03-04, 2014.
5. **[N, P] Borfecchia, E.**; Garino, C.; Gianolio, D.; Salassa, L.; Gobetto, R.; Lamberti, C. *Ultrafast X-ray absorption and scattering techniques to probe the photochemistry of cis-[Ru(bpy)₂(py)₂]²⁺*, XXI Italian Synchrotron Radiation Society (SILS) National Meeting, @ FisMat 2013, Milan (Italy), September 09-13, 2013.
6. **[I, P] Mino, L.; Borfecchia, E.**; Groppo, C.; Castelli, D.; Martinez Criado, G.; Lamberti, C. *Iron oxidation state variations in zoned micro-crystals measured using micro-XANES*, E-MRS 2013 Spring Meeting, Strasbourg (France), May 27-30, 2013.
7. **[I, P] Mino, L.; Borfecchia, E.**; Pagliero, A.; Cagliero, S.; Agostino, A.; Truccato, M.; Martinez Criado, G.; Lamberti, C. *Effect of thermal and radiation induced damage in Bi-2212 superconducting whiskers investigated by in situ structural and electrical characterization*, E-MRS 2013 Spring Meeting, Strasbourg (France), May 27-30, 2013.
8. **[I, P] Borfecchia, E.**; Ruiu, T.; Garino, C.; Salassa, L.; Gianolio, D.; Gobetto, R.; Sadler, P. J.; Cammarata, M.; Wulff, M.; Lamberti, C. *Photo-induced structural modifications in [Ru(bpy)₂(py)₂]Cl₂ investigated by time-resolved X-ray solution scattering*, Finelumen International Summer School 2011, Łochów (Poland) 23-27 May, 2011.
9. **[N, P] Borfecchia, E.**; Ruiu, T.; Garino, C.; Salassa, L.; Gianolio, D.; Gobetto, R.; Sadler, P. J.; Cammarata, M.; Wulff, M.; Lamberti, C. *Photo-induced structural modifications in [Ru(bpy)₂(py)₂]Cl₂ investigated by sub-ns Time-resolved X-ray Solution Scattering: a preliminary analysis*, XVIII Italian Synchrotron Radiation Society (SILS) National Meeting, Padova (Italy), June 24-26, 2010.

Invited Talks to Industrial Workshops

1. **Borfecchia, E.**, "Cu-zeolites for the partial oxidation of methane to methanol: comparing small and large pore topologies by operando XAS", Haldor Topsøe A/S PhD/Postdoc Workshop 2017, Kgs. Lyngby (Denmark), March 08, 2017.
2. **Borfecchia, E.**, "Recent insights in the Cu-CHA catalyst by in situ and operando X-ray spectroscopies: Cu speciation during dehydration at different composition and temperature-dependent SCR", Haldor Topsøe A/S Cu-workshop 2016, Kgs. Lyngby (Denmark), September 05, 2016.
3. **Borfecchia, E.**, "SCR-relevant Cu species in the Cu-CHA catalyst: results and perspectives from in situ/operando synchrotron spectroscopies", Haldor Topsøe A/S Cu-workshop 2015, Kgs. Lyngby (Denmark), May 05, 2015.
4. **Borfecchia, E.**, "Structural and electronic properties of Cu-sites in Cu-SSZ-13: a XAS/XES investigation". Haldor Topsøe A/S Cu-zeolite SCR workshop 2014, Kgs. Lyngby (Denmark), February 18, 2014.

Invited Seminars and Lessons at International Research Institutions

1. **Borfecchia, E.**; *X-ray spectroscopy to understand selective redox catalysis over Cu-zeolites*. Diamond Spectroscopy seminars, Diamond Light Source, Didcot (UK), May 10, 2019.
2. **Borfecchia, E.**; *X-ray spectroscopy to understand nanocatalysts: a case study for my trajectory in research*, NuovaMente Chimica Initiative, Chemistry Dept. University of Turin, Turin (Italy), April 18, 2019.
3. **Borfecchia, E.**, "Quantifying Cu-speciation in Cu-zeolite catalysts by XAS MCR analysis: a novel opportunity in structure-performance correlation", ESRF spectroscopy seminars, European Synchrotron Radiation Facility (ESRF), Grenoble (France), May 30, 2018.
4. **Borfecchia, E.**, "Shedding (synchrotron) light on active metal sites: the unique potential of hard X-ray spectroscopies in heterogeneous catalysis", Tutorial Seminar, Department of Chemistry, University of

Oslo (Norway), February 22, 2016.

Organization of scientific events

- Organizer, International Winter School “Innovative catalysis and sustainability: scientific and socio-economic aspects”, Bardonecchia (Italy), January 07-11, 2019.
- Organizer, NIS colloquium “Cu-based zeolites, versatile materials for redox catalysis”, Department of Chemistry, University of Turin, Turin (Italy), July 20, 2018.

Chair for:

- NIS colloquium “Cu-based zeolites, versatile materials for redox catalysis”, Department of Chemistry, University of Turin, Turin (Italy), July 20, 2018.
- Shot Section ‘SS2: *Methane valorization*’, Europacat 2017 (27-31/08/17, Florence, Italy)

Participation to popular science events

- **Invited speaker** at the “*Nano-day 2016*”, Turin, Italy, March 15, 2016 (<http://www.agorascienza.it/index.php/it/i-progetti/nanoday/2016>)

ANNEX III. COMPLETE LIST OF EXPERIMENTS AT LARGE SCALE SYNCHROTRON FACILITIES

[CP] = Co-proponent; [MP] = Main proponent
[EXP] = Member of the experimental team

Year	Role	Description
2020	CP	1. Elettra, Proposal 20195143 "Assessing the Ti-peroxo/Ti-hydroperoxo equilibrium in titanium silicalite-1 by NEXAFS spectroscopy in environmental conditions", beamline APE-HE, 20/07/2020-25/07/2020.
	CP	2. Max IV, Proposal 20190347 "Assessing Cu-Speciation in Cu-Zeolites during CH ₄ -TPR", beamline Balder, 28/02/2020 to 02/03/2020.
	MP, EXP	3. Elettra, Proposal 20190128 "Shedding light on Cu/active oxygen species in zeolite catalysts by ambient-pressure NEXAFS", beamline APE-HE, 20/01/2020-26/01/2020.
2019	MP, EXP	4. SOLEIL, Proposal 20181276: "Exploring by operando XAS the CO ₂ to light olefins conversion over PdZn/zeolite bifunctional catalysts", beamline ROCK, 10/07/2019-15/07/2019.
	CP, EXP	5. Elettra, Long Term Project 20170124 "Site/reactants interaction in heterogeneous catalysts highlighted by operando TEY NEXAFS experiments at ambient pressure", beamline APE-HE (Exp. 4/4), 04/06/2019-10/06/2019.
	CP, EXP	6. Diamond Light Source, Proposal SP21713: "Ethene dimerization with Ni(II)-bipyridine functionalized MOFs", beamline B18, 08/05/2019-13/05/2019.
	CP, EXP	7. ESRF, Proposal 31-01-87: "CO ₂ to light olefins conversion by cascade reactions over bifunctional PdZn/zeolite catalysts: understanding the bimetallic component by XAS", beamline BM31, 11/11/2018 – 13/11/2018.
2018	CP, EXP	8. ESRF, Proposal CH-5561: "Investigating the nitrate-mediated limiting step in the SCR pathway by operando XAS/DRIFT", beamline BM23: 24/10/2018 – 29/10/2018
	CP, EXP	9. ESRF, Proposal CH-5563: "Exploring by XAS the solution behaviour of heterobimetallic Zn-Au coordination complexes for growth unit analysis of new luminescent materials", beamline BM23: 24/08/2018 – 28/08/2018
	CP, –	10. Elettra, Long Term Project 20170124 "Site/reactants interaction in heterogeneous catalysts highlighted by operando TEY NEXAFS experiments at ambient pressure", beamline APE-HE (Exp. 2/4): 28/05/2018 - 03/06/2018
	MP, EXP	11. ESRF, Proposal CH-5378: "Direct methane to methanol conversion on outperforming Cu-MOR catalysts: unraveling Cu-active sites and reaction mechanism by operando XAS", beamline BM23: 28/03/2018 - 03/04/2018.
	CP	12. ESRF, Proposal MA-3795: "Study of X-ray nanopatterning mechanism on Bi ₂ Sr ₂ CaCu ₂ O _{8+x} by X-ray nanodiffraction", beamline ID13: 11/02/2018 - 16/02/18.
	CP, EXP	13. ESRF, Proposal CH-5212 "Study of the activation mechanism of an osmium antitumor drug using XAS spectroscopy", beamline BM23: 08/02/2018 - 13/02/18.
	CP, EXP	14. ESRF, Proposal CH-5198 "Exploring by XAS the formation and the local electronic and structural properties of Zn ⁺ ions in H-ZSM-5 zeolite", beamline BM23: 14/02/18 - 20/02/2018.
2017	CP	15. Elettra, Long Term Project 20170124 "Site/reactants interaction in heterogeneous catalysts highlighted by operando TEY NEXAFS experiments at ambient pressure", beamline APE-HE (Exp. 1/4): 10/12/2017 - 16/12/2017
	CP, EXP	16. ESRF, Proposal CH-5289 "Radiation-induced active sites modification of Cu-CHA catalyst", beamline ID24: 25/10/2017 - 31/10/2017.

	CP, EXP	17. ESRF, Proposal 31-01-48 "Operation-induced yield improvement in Cu-zeolite catalysts for the direct methane to methanol conversion: a combined quasi-simultaneous XAS/PXRD study", beamline BM31: 20/09/2017 - 26/09/2017.
	CP	18. ESRF, Proposal MA-3506: "Exploration of X-rays Nano-Patterning on TiO ₂ ", beamline ID16NA: 10/05/2017 - 15/05/2017.
	MP, EXP	19. ESRF, Proposal CH-5116: "Exploring by HERFD XANES and XES the direct methane to methanol conversion on Cu-zeolites and Cu-MOFs", beamline ID26: 19/04/2017 - 25/04/2017.
	CP	20. ESRF, Proposal CH-4669: "Structure and redox properties of mixed Ce-Zr UiO-66 MOFs", beamline BM31: da 15-02-2017 a 21-02-2017.
	CP	21. ESRF, Proposal MA-3256: "Validation of X-ray nanopatterning via extension to YBCO superconducting oxide", beamline ID13: 03/02/2017 - 07/02/2017.
2016	CP	22. ESRF, Proposal MA-3256: "Validation of X-ray nanopatterning via extension to YBCO superconducting oxide", beamline ID16NA: 29/11/2016 - 05/12/2016.
	MP, EXP	23. ESRF, Proposal CH-4829: "Exploring the direct methane to methanol conversion on Cu-zeolites and Cu-MOFs: a combined XAS/XES study", beamline BM26A: 09/11/2016 - 14/11/2016.
	MP, EXP	24. ESRF, Proposal CH-4969: "Structure-activity relationship in the deNO _x Cu-CHA catalyst: exploring the effect of composition tuning by HERFD-XANES and XES", beamline ID26: 02/11/2016 - 08/11/2016.
	CP, EXP	25. ESRF, Proposal CH-4667 "Operando XAS/XES study of Fe ²⁺ -, Co ²⁺ -, and Mn ²⁺ -substituted MOF-5", beamline BM23: 13/04/2016 - 19/04/2016; beamline ID20: 20/07/2016 - 26/07/2016.
	CP	26. ESRF, Proposal CH-4688 "Dynamic behavior of Pd/P4VP catalyst during the selective aerobic oxidation of alcohols: a simultaneous SAXS-XAS in operando study", beamline BM26A: 13/07/2016 - 18/07/2016.
	MP, EXP	27. ESRF, Proposal CH-4661 "Structure-activity relationship in the deNO _x Cu-CHA catalyst: exploring the effect of composition tuning by XAS and XES", beamline BM23: 22/06/2016 - 28/06/2016.
	CP, EXP	28. ESRF, Proposal MA-3012 "Towards superconducting THz emitters patterned by means of X-ray nanolithography", beamline ID16NA: 07/04/2016 - 12/04/16.
	CP, EXP	29. ESRF, Proposal CH-4504 "In situ XAS study of the Zn-sites in the Zn-ZSM-5 catalyst for the methanol to aromatics (MTA) process", beamline BM23: 11/02/2016 - 16/02/2016.
	CP	30. ESRF, Proposal CH-4503 "Structural determination of mixed Zr-Ce UiO-66 metallorganic framework and related redox catalysis", beamline ID22: 11/02/2016 - 15/02/2016.
	2015	CP
CP, EXP		32. ESRF, Proposal MA-2790: "Structural and functional modulations induced by direct-writing X-ray nanolithography in technologically relevant oxides", beamline ID16NA: 26/11/2015 - 02/12/2015.
CP, EXP		33. ESRF, Proposal CH-4217: "QD-mediated photoreduction of Pt(IV) anticancer agents", beamline BM23: 04/02/2015 - 07/02/2015.
CP, EXP		34. ESRF, Proposal MA-2054: "Nanoscale chemical composition and structural modifications in THz devices obtained from superconducting whiskers by Ga-FIB", beamline ID16B-NA: 30/01/2015 - 03/02/2015.
2014	CP, EXP	35. ESRF, Proposal CH-4222: "Combined XAS and XRD study of Ru-, Rh- and Pd-functionalized UiO-67 metal-organic frameworks", beamline BM23: 01/10/2014 - 05/10/2014.

	CP, EXP	36. ESRF, Proposal MA-2416: "Exploring the mechanisms and potentials of a novel X-ray nanolithography technique for superconducting oxides", beamline ID16-NA: 02/10/2014 – 08/10/2014.
	CP, EXP	37. ESRF, Proposal CH-4080: "The structural and electronic configuration of Cu active sites in Cu-SSZ-13 and Cu-ZSM-5 under SCR conditions: a combined operando XAS and XES study", beamline BM23: 30-04-2014/06-05-2014; beamline ID26: 10-06-2014/14-06-2014.
	CP	38. ESRF, Proposal CH-4050: "Understanding of the electronic-promoting effect of Ir in bimetallic Ir-Mo/Al ₂ O ₃ catalysts for hydrotreating reactions: a XES/XAS/XRS study", beamline BM23: 25/04/2014 – 29/04/2014.
2013	EXP	39. MAX-II, Proposal n° 20130280: "XANES, EXAFS and Quick EXAFS on MOFs of the UiO family", 01/10/2013 – 07/10/2013.
	EXP	40. ESRF, Proposal CH-3796: "The electronic structure of Cu-based molecular complexes hosted inside zeolite-frameworks: an in situ XAS and XES study", beamline BM23: 10/04/2013 a 14/04/2013; beamline ID26: 03/07/2013 a 09/07/2013.
2012	CP, EXP	41. ESRF, Proposal CH-3393: "Solvent rearrangement during ligand photodissociation from cis-[Ru(bpy) ₂ (py) ₂]Cl ₂ investigated by TR-WAXS and anomalous scattering", beamline ID09B: 06/06/2012 – 11/06/2012.
	CP, EXP	42. ESRF, Proposal MA-1510: "Radiation damage on superconducting micro-crystal and nano-devices", beamline ID22: 23/05/2012 a 28/05/2012.
2011	CP	43. ESRF, Proposal CH-3449: "Electronic Structure Investigation on Photoactive Ruthenium Anticancer Complexes by Resonant X-ray Emission Spectroscopy", beamline ID26: 26/10/2011 – 01/11/2011
	CP, EXP	44. ESRF, Proposal CH-3333: "In situ electronic structure characterization of Cu- and Co-containing porous polymer relevant in red-ox catalysis: a RIXS/RXES study", beamline BM01B: 08/07/2011 a 12/07/2011
	EXP	45. ESRF, Proposal CH-3346: "SAXS and EXAFS of Pd nanoparticles stabilized inside DVB-cross-linked polymeric supports", beamline BM26A: 06/07/2011 – 11/07/2011.
2010	EXP	46. ESRF, Proposal CH-3323: "RIXS study of the electronic structure of metal centers hosted inside MOFs in the presence and absence of adsorbates: the key to understanding molecular adsorption", beamline BM26: 29/11/2010 – 01/12/2010; beamline ID26: 26/10/2010 a 03/11/2010
	EXP	47. ESRF, Proposal EC-731: "Redox state of the subducting slab at convergent tectonic margins: new insights from a micro-XANES study of an eclogitic gabbro", beamline ID22: 08/09/2010 – 12/09/2010.
	CP, EXP	48. APS, Proposal GUP-12873: "Ligand photodissociation in [Ru(bpy) ₂ (py) ₂]Cl ₂ using TR-EXAFS", beamline 11-ID-D: 10/03/2010 – 16/03/2010.
2009	CP, EXP	49. ESRF, Proposal: CH-2948: "Excited state investigation of photoactivable Ru anticancer complexes part II: increasing the contrast", beamline ID09B: 09/12/2009 a 15/12/2009.
	EXP	50. ESRF, Collaboration for a feasibility test of Time-Resolved XAS measurements on the beamline ID09B", beamline ID09B: 13/09/2009 a 16/09/2009.
2008	EXP	51. ESRF, Proposal CH-2719: "Excited state investigation of photoactivable Ru anticancer complexes", beamline ID09B: 16/11/2008 a 21/11/2008 (associated with Master Thesis Project).

ANNEX IV. COMPLETE LIST OF (CO-)SUPERVISED MASTER AND PhD THESES

<i>Master Theses</i>			
Session	Student	Master Degree	Role/ Thesis title
Ongoing	Raj Krishna Shrestha	Materials Science University of Turin	Supervisor / Application of in situ NEXAFS spectroscopy to heterogeneous catalysts
04/2019	Riccardo Colasanti	Drug Chemistry and Technology University of Turin	Co-supervisor / Catalizzatori a base di Cu(II) per catalisi redox: confronto tra supporti di natura organica ed inorganica
07/2017	Anna Marsicano	Physics University of Turin	Co-supervisor / Understanding Cu-zeolite catalysts for the direct methane conversion by in situ and operando XAS/XES experiments
12/2016	Andrea Melloni	Physics University of Turin	Co-supervisor / Metal-substituted MOF-5 investigated by X-ray absorption and emission spectroscopies
12/2016	Andrea Martini	Physics University of Turin	Co-supervisor / Active sites in zeolite-based catalysts probed by X-ray synchrotron techniques
07/2014	Elisa Chiari	Physics University of Turin	Co-supervisor / Structural determination of metal-functionalized metallorganic frameworks by X-ray absorption spectroscopy
<i>PhD Theses</i>			
Session	Student	PhD Course	Role / Thesis Title
01/2016	Kirill A. Lomachenko	Chemistry and Materials Science ¹ University of Turin	Co-supervisor / Local environment and electronic structure of catalytically active transition metal centers in nanoporous materials determined by X-ray absorption and X-ray emission spectroscopy
11/2017	Luca Braglia	Chemistry and Material Science ¹ University of Turin	Co-supervisor / MOFs functionalized with catalytically active metal sites investigated by X-ray absorption spectroscopy
12/2018	Chiara Negri	Chemistry and Material Science University of Turin	Co-supervisor / Operando approaches to investigate advanced materials
12/2019	Ilia A. Pankin	Chemistry and Material Science ¹ University of Turin	Co-supervisor / Structural and electronic characterization of functionalized materials via synchrotron radiation experiments and theoretical simulations
Ongoing (I year)	Karoline Kvande	Chemistry University of Oslo	Co-supervisor / Direct activation of lower alkanes over transition metal containing catalysts
Ongoing (III year)	Andrea Martini	Chemistry and Material Science ¹ University of Turin	Co-supervisor / Understanding the nature and the evolution of chemical species by chemometric analysis of <i>operando</i> and <i>in situ</i> spectroscopic data.
Visiting PhD student ²	Casper W. Andersen	Chemistry Aarhus University	Characterization of extra-framework species in zeolites

¹ In cotutelle with Southern Federal University, Rostov on Don (Russia).

² At Chemistry Dept. University of Turin, 08-12/2016.