



ESRF EBS: EXTREMELY BRILLIANT SOURCE
Call for Expressions of interest
(5 pages maximum)

Please send the completed form by 11th March 2016 to the Directors of Research (up2eoi@esrf.fr).

Contact	<p>Carlo Lamberti IRC “Smart Materials”, Southern Federal University, Rostov-on-Don (Russia) and Department of Chemistry, NIS and INSTM Reference Centers, University of Turin, Turin (Italy). carlo.lamberti@unito.it</p> <p>Jan-Dierk Grunwaldt, Karlsruher Institut für Technologie (KIT) Institut für Technische Chemie und Polymerchemie (ITCP) Engesserstr. 20, 76131 Karlsruhe, Germany grunwaldt@kit.edu</p> <p>CL and JDG are actually just the scientists who promoted this expressions of interest among colleagues and who formally submit it to the ESRF Scientific Directors. The document is the result of the constructive interaction among all scientists (113) that have signed this document.</p>
Title and Scientific area	<p>The future of catalysis (heterogeneous, homogenous, enzymatic), photocatalysis and electrocatalysis at the ESRF</p> <ul style="list-style-type: none"> • Chemistry • Catalysis: • Physical Chemistry • Chemical Physics • Energy (materials for energy use & storage)
Scientific case	<p>Development of a flexible characterization platform of synchrotron radiation (SR) beamlines that allows (i) the investigation of materials and catalysts at any stage of preparation, (ii) to follow their performance during working conditions and (iii) to study the deactivation mechanisms via <i>in situ</i> monitored accelerated live tests. This requires methods that provide key insights into the active catalytic centres by studying short, medium and long-range structure, as well as</p>

vibrational and electronic properties. The possible combination of complementary SR techniques (SAXS/WAXS, SAXS/XAS, XAS/WAXS-PDF, and imaging techniques using micro- and nano-beams) should be encouraged. The potentialities of the ID18 beamline for nuclear resonance experiments (e.g. ^{57}Fe) should be exploited. The development of a hard X-ray XPS beamline is suitable. State of the art laboratory characterization methods (IR, Raman, UV-Vis) should be coupled with SR X-ray scattering/XAS/XES experiments. Software frameworks for on-line analysis of a multi-technique experiment should be developed and optimized. Special attention should be devoted to the optimization of multi-probe *in situ/operando* spectroscopic setups. New methodologies should be developed to monitor, with sufficient temporal and spatial resolution, catalytically active species. The possibility to investigate extremely diluted systems, required e.g. in enzymatic catalysis (but also in some industrial catalyst), should also be foreseen. The presence of the ESRF central chemistry lab represents a powerful and indispensable support to our community. The infrastructure at some ESRF beamlines devoted to support the catalytic community should include small local laboratories for basic chemical preparation and the possibility to set-up *in situ/operando* cells. For the latter studies, gas lines are required allowing the interaction of desired gas mixtures with the catalyst operating in temperature and pressure ranges of 77-1100 K and 10^{-3} – 10 bar respectively (for some specific reactions 50 bar will be required). For such experiments mass spectrometers and online micro GC are essential for outlet gas analysis studying product distributions. Steam from pre-heated lines should be available, as well as dedicated *in-situ/operando* cells designed for feeding the catalyst from the liquid phase. For homogeneous catalysis, one would benefit from Schlenk line facilities in the experimental hutch. For energy materials (batteries, fuel cells) potentiostats and gas handling systems (as above) are required. The possibility to perform both gas and liquid phase studies will allow investigating paths towards a more sustainable production of all C-based materials, i.e. the chemicals and fuels of the future, using a wide range of feedstocks – a concept that is in accordance with EU visions and strategies.

Concerning the last point “(iii) catalyst deactivation”, usually accelerated aging processes are used to be able to follow at the synchrotron and on a day-scale catalyst deactivation that typically occurs over periods of months inside an industrial reactor. Here it would be a breakthrough development to implement a new type of long-term proposal scheme, where access to XRPD or XAS beam time can be granted for a few

	<p>hours every 2 weeks over one year. If the community is sufficiently large one could imagine hosting 2 (4) of such projects in 1 (2) shifts every 2 weeks for one year.</p>
<p>Justification for the requesting ESRF-II capabilities</p>	<p>The higher brilliance of the machine will allow to explore new frontiers in both time and space resolved experiments.</p> <p>Time resolved XAS experiments: stable and reproducible Quick-XAS set-ups will allow obtaining good quality XAS data within few minutes to ms, which is essential, for example, in red-ox catalysis or when studying red-ox reactions or so-called structure sensitivity effects where dynamically changing particular atomic coordination of the catalyst have exponentially higher reactivity. Dispersive XAS (ID24) will allow covering shorter time frames of a few seconds to μs. To fully benefit from the potential time resolution available with Quick-XAS and Dispersive XAFS improvement of sample cells is required. In particular to achieve time resolution needed in order to induce a gradient in the chemical composition of the gas (liquid) feed needs to be optimized to match the time resolution of the used method: development of pulse reactors compatible with transmission XAS is therefore requested. Finally, laser pump / X-ray probe photochemistry will shed light on the excited states of a photo catalyst down to the ns and ps regimes.</p> <p>Time resolved X-ray scattering experiments. 2D detectors will allow to follow the evolution of systems at all relevant time scales with SAXS, WAXS and, working at very short λ, the collection of high S/N WAXS patterns will become suitable for PDF analysis (ID15, ID11, ID22).</p> <p>Time resolved XES experiments: Time-resolved XES and HERFD experiments will result in a complete understanding of the electronic structure (both occupied and unoccupied DOS) of the catalyst active site in working conditions. The increased photon flux will allow more beamlines to be equipped with XES spectrometers. <i>Operando</i> photon-in/out based experiments will enable tracking multiple sites with multiple detectors, for example tracking Co^{2+} and Co^{3+} in an active catalyst. The availability of a XES spectrometer working in the von Hamos geometry will be welcome, making pump-probe XES possible.</p> <p>Modulation techniques in time resolved experiments: The higher sensitivity will significantly impact the possibility of isolating surface from bulk species by modulation techniques. Transient experiments (XRD, XAS and possibly XES and PDF) using equipment with higher sensitivity will further enable researchers to perform simultaneous measurements of surface and gas phase species, and thereby to elucidate correlations</p>

between kinetic parameters of catalytic reactions and the presence of specific surface species or phases. Such experiments will also allow the discrimination between active species and spectators.

Spatially resolved experiments: micro-beams will allow the determination of a possible speciation gradient inside a catalytic fixed bed, or battery (electrode vs electrolyte), while sub-micron beams will allow structural and spectroscopic characterization of a single crystal catalyst (typically: zeolite, oxide, MOF particle or bifunctional catalysts including catalysts for fluidized bed reactors). Nanoscale 3D imaging, under reaction conditions, can provide insight into the chemical species and their evolution as a function of space and time giving important insight into the understanding of heterogeneous catalysts in working conditions. This holds for both 3D-oxidation state mapping (XANES), 3D-first shell mapping (EXAFS) and 3D-phase mapping (XRD) representing a new frontier for tomography. The increased brilliance will not only allow for faster collection times during imaging but also offer higher spatial resolution using for example coherent diffraction imaging. These new capabilities will pave the way for 2D and 3D in-situ/operando studies of working catalysts at unprecedented spatial and temporal resolution.

Software improvement and data storage/accessibility: Time- and space-resolved techniques require software capable of treating and analyzing large amount of data (up to several TB/week). To allow the best scientific output from the collected datasets, a software development should be foreseen in parallel to the improved performances of the beamlines. This software should obviously be available for the users. One other important issue is data storage. Currently users are allowed to store raw data for ~ 6 weeks before it is backed up by tape. This is often not long enough to do the data pre-processing particularly of large data sets (TB). The development of time- and space-resolved experiments will make this problem more relevant. Even having external hard drives it still takes too long to do the data transfer (even with gigabit connection). So the entire ESRF users' community (not only the catalysis one) needs a progressive approach towards data storage and access protocols/infrastructure especially in light of the more global interest in the availability of 'big data'.

Beam damage control: A systematic procedure able to check possible radiation damage effects will be relevant to obtain reliable results. It will be important to develop a tested protocol able to determine quantitatively how many minutes (seconds or ms) a given sample is able to survive under the beam and to develop macros able to collect the whole spectrum (pattern) by (i) sampling different points of the sample for a time allowing

	<p>sample survival under the beam or (ii) while performing a continuous horizontal/vertical scan of the sample in the beam.</p> <p>Problem solving for 90% of the catalysis community. The upgrade needs also to guarantee and improve the operation and beam stability of the actual bending magnets beamlines. Some of these bending magnet beamlines with exceptional infrastructure, such as BM23, SPLINE, ROBL-RCH, SNBL, LISA, BM30 or DUBBLE, have produced significant contributions in the field of homogeneous, heterogeneous and enzymatic catalysis. The same holds for the XRPD beamlines (ID22, SNBL). High quality XAS and XRPD attracts large interest from both academic and industrial users. We believe that the ESRF cannot lose this community.</p>
<p>Size of potential user community (including a list of interested groups)</p>	<p>As equally testified by the significant percentage of papers devoted to catalysis in the proceedings of XAFS conferences and the number of papers using SR radiation presented at catalysis conferences (see Tables 1, 2 in <i>Chem. Rev.</i> 2013, <i>113</i>, 1736–1850) the catalysis community is intensely using SR. Moreover, at the XAFS16 conference (Karlsruhe 2015), there was a catalysis workshop, an industrial symposium (where catalysis played a central role), and the number of delegates belonging to the catalysis and materials science community was the highest.</p> <p>This document has been supported by 113 scientists belonging to 12 countries, 40 different universities, 10 research centres and 10 industries (see the attached list with addresses and e-mails) and from the following societies: the <i>Italian Synchrotron Radiation Society</i> (SILS, http://www.synchrotron-radiation.it/index.php/en/, president: A. Di Cicco); the <i>Interdivisional Group of Catalysis of the Italian Chemical Society</i> (GIC @ AIC, https://www.soc.chim.it/it/gruppi/catalisi/benvenuto , coordinator: P. Pollesel); the <i>European Cluster on Catalysis</i> (http://www.catalysiscluster.eu/ , Scientific Advisor: G. Centi); <i>Norwegian national centre of industrial Catalysis Science and Innovation</i> (ICSI, https://www.ntnu.edu/icsi/facilities , Director: H. J. Venvik,); <i>German Kommittee für Synchrotronstrahlung</i> (KFS, https://www.sni-portal.de/kfs/index-engl.php , Ronald Frahm, Peter Albers and Jan-Dierk Grunwaldt).</p>

For any further information, please contact the Directors of Research, Jean Susini (susini@esrf.fr) and Harald Reichert (reichert@esrf.fr).

List of scientists supporting the document (in random order)

Family Name	Given name	address	e-mail
Sankar	Gopinathan	Department of Chemistry University College London 20 Gordon Street London WC1H 0AJ, United Kingdom	g.sankar@ucl.ac.uk
Coperet	Christophe	Department of Chemistry ETH Zurich / HCI H 229 Wolfgang-Pauli-Str. 10 8093 Zurich, Switzerland Phone: +41-44-633 9394	ccoperet@inorg.chem.ethz.ch
Corma	Avelino	Instituto de Tecnología Química, UPV-CSIC, Universidad Politécnica de Valencia, Avda. de los Naranjos s/n, 46022 Valencia, Spain	acorma@itq.upv.es
Weckhuysen	Bert	Department of Inorganic Chemistry and Catalysis Utrecht University, Sorbonnelaan 16, 3584 CA Utrecht, Netherlands	b.m.weckhuysen@chem.uu.nl
Meirer	Florian	Department of Inorganic Chemistry and Catalysis Utrecht University, Sorbonnelaan 16, 3584 CA Utrecht Netherlands	f.meirer@uu.nl
Blom	Richard	SINTEF - Hydrocarbon Process Chemistry P.O. Box 124 Blindern, 0314 Oslo (Norway)	Richard.Blom@sintef.no
Akporiaye	Duncan	SINTEF - Materials and Chemistry, Forskningsveien 1, Oslo (Norway)	Duncan.Akporiaye@sintef.no
Cruciani	Giuseppe	Dipartimento di Scienze della Terra, Sez. Mineralogia, Petrologia e Geofisica, Università di Ferrara, Via Saragat 1, I-44100 FERRARA (Italy)	cru@unife.it
Grunwaldt	Jan-Dierk	Institute for Chemical Technology and Polymer Chemistry, Karlsruhe Institute of Technology (KIT), Engesserstr. 20, D-76131 Karlsruhe, Germany	grunwaldt@kit.edu
van Bokhoven	Jeroen A.	ETH Zurich, Institute for Chemical and Bioengineering, HCI E127 8093 Zurich, Switzerland	j.a.vanbokhoven@chem.ethz.ch
Tromp	Moniek	Universiteit van Amsterdam Van 't Hoff Institute for Molecular Sciences (HIMS) Postbus 94157, 1090 GD AMSTERDAM	m.tromp@uva.nl
Evans	John	University of Southampton, Southampton SO17 1BJ, UK, Diamond Light Source, Oxfordshire, United Kingdom	john.evans@diamond.ac.uk
Olsbye	Unni	Department of Chemistry, University of Oslo, Norway	unni.olsbye@kjemi.uio.no
Lillerud	Karl Petter	Department of Chemistry, University of Oslo, Norway	k.p.lillerud@kjemi.uio.no
Fjellvåg	Helmer	Department of Chemistry, University of Oslo, Norway	helmer.fjellvag@kjemi.uio.no
Frenkel	Anatoly I.,	Department of Physics, Yeshiva University, 245 Lexington Avenue, New York, NY 10016, USA	anatoly.frenkel@yu.edu
Gualtieri	Alessandro	Università di Modena e Reggio Emilia, Dipartimento di scienze della Terra, Largo S. Eufemia 19, I-41100-Modena (Italy)	gualtieri.alessandro@unimore.it
Dincă	Mircea	Massachusetts Institute of Technology (MIT), USA	mdinca@mit.edu
Llabrés i Xamena	Francesc X.	Instituto de Tecnología Química CSIC-UPV Universidad Politécnica de Valencia, Avda. de los Naranjos, s/n, 46022 Valencia, Spain	fllabres@itq.upv.es

Soldatov	Alexander V.	Director, International Research Center "Smart Materials", Southern Federal University of Russia, Zorge 5, Rostov-on-Don, 344090, Russia	soldatov@sfedu.ru
Lomachenko	Kirill A.	International Research Center "Smart Materials", Southern Federal University of Russia, Zorge 5, Rostov-on-Don, 344090, Russia	kirlom@gmail.com
Guda	Alexander A.	International Research Center "Smart Materials", Southern Federal University of Russia, Zorge 5, Rostov-on-Don, 344090, Russia	guda_sasha@mail.ru
Bugaev	Aram	International Research Center "Smart Materials", Southern Federal University of Russia, Zorge 5, Rostov-on-Don, 344090, Russia	arambugaev@gmail.com
Prestipino	Carmelo	Sciences Chimiques de Rennes, UMR 6226, Solid State and Materials Chemistry group (CSM), Campus de Beaulieu, Bât 10B, bureau 122, 263 avenue du Général Leclerc, F-35042 RENNES, France	carmelo.prestipino@univ-rennes1.fr
Fernández-García	Marcos	ICP-CSIC, C/Marie Curie 2, 28049-Madrid, Spain	mfg@icp.csic.es
Ferri	Davide	Catalysis for Energy, Paul Scherrer Institute, OLGA/411, 5232 Villigen – PSI, Switzerland	davide.ferri@psi.ch
Beale	Andrew	Address: Research Complex at Harwell (RCaH) Rutherford Appleton Laboratory Harwell Oxford Didcot Oxon OX11 0FA United Kingdom	andrew.beale@ucl.ac.uk
Joly	Yves	Institut Neel, CNRS & Université Joseph Fourier, BP166, F-38042 Grenoble Cedex 9, France	yves.joly@neel.cnrs.fr
Soldo-Olivier	Yvonne	Institut Neel, CNRS & Université Joseph Fourier, BP166, F-38042 Grenoble Cedex 9, France	yvonne.soldo@neel.cnrs.fr
Stock	Norbert	University of Kiel, Germany	stock@ac.uni-kiel.de
Quadrelli	Alessandra	CPE Lyon, 43 Bd du 11 Nov. 1918, 69616 Villeurbanne cedex FRANCE	quadrelli@cpe.fr
Gascon	Jorge	Catalysis Engineering / ChemE / TUDelft, Julianalaan 136, 2628 BL Delft, The Netherlands	J.Gascon@tudelft.nl
Ronning	Magnus	Department of Chemical Engineering, Norwegian University of Science and Technology (NTNU), NO-7491 Trondheim, Norway	magnus.ronning@ntnu.no
Venvik	Hilde J.	Department of Chemical Engineering, Norwegian University of Science and Technology (NTNU), NO-7491 Trondheim, Norway	hilde.j.venvik@ntnu.no
Pellegrini	Riccardo	Chimet SpA - Catalyst Division, Via di Pescaiola 74, Vicinaggio Arezzo, I-52041 Italy	Riccardo.Pellegrini@chimet.com
Beato	Pablo	Haldor Topsøe A/S, Haldor Topsøes Allé 1, DK-2800 Kgs. Lyngby; Denmark	pabb@topsoe.dk
Tyrsted,	Christoffer	Haldor Topsøe A/S, Haldor Topsøes Allé 1, DK-2800 Kgs. Lyngby, Denmark	chty@topsoe.dk
Fuglerud	Terje	Technology and Projects, INEOS ChlorVinyls, Heroya Industrial Park, N-3936, Porsgrunn, Norway	Terje.Fuglerud@ineos.com
Salassa	Luca	CIC BiomaGUNE, Edificio Empresarial "C", Paseo de Miramón 182, 20009 Donostia -San Sebastián - Spain	lsalassa@cicbiomagune.es
de Groot	Frank M. F.	Department of Chemistry, Utrecht University, Universiteitsweg 99, 3584CG Utrecht, The Netherlands	F.M.F.deGroot@uu.nl

de Jong	Krijn P.	Department of Chemistry, Group of Inorganic Chemistry and Catalysis, Utrecht, Netherlands	k.p.dejong@uu.nl
Martucci	Annalisa	Università degli Studi di Ferrara Dipartimento Di Fisica E Scienze Della Terra, Via Saragat, 1, 44100 – Ferrara, Tel: +39-(0)532974730, Fax: +39 (0)532210161	mrs@unife.it
Lercher	Johannes A.	Technische Universität München, Department Chemie, Lichtenbergstr. 4, D-85747 Garching, Germany	johannes.lercher@ch.tum.de
Jentys	Andreas	Technische Universität München, Department Chemie, Lichtenbergstr. 4, D-85747 Garching, Germany	jentys@mytum.de
Christoph	Müller	ETH, Dep. Maschinenbau und Verf.technik, LEE P 201, Leonhardstrasse 21, 8092 Zürich, Switzerland	muelchri@ethz.ch
de Jongh	Petra E.	Debye Institute for Nanomaterials Science - Utrecht University, David de Wiedgebouw (k 4.84), Tel +31 30 2531747, Universiteitsweg 99, 3584 CG Utrecht, The Netherlands	P.E.deJongh@uu.nl
Bitter	J.H. (Harry)	Professor Biobased Chemistry and Technology (BCT), Wageningen University & Research centre, P.O. Box 17, 6700 AA Wageningen, The Netherlands	harry.bitter@wur.nl
Cavani	Fabrizio	Dipartimento di Chimica Industriale ALMA MATER STUDIORUM Università di Bologna, Viale Risorgimento 4, 40136 Bologna, Tel +39-0512093680 Fax +39-0512093675	fabrizio.cavani@unibo.it
Signoretto	Michela	Department of Molecular Sciences and Nanosystems, Ca' Foscari University Venezia, Calle Larga S. Marta, 2137, I-30123 Venezia (Italy), Tel: (41) 2348650; Fax: (41) 2348517	miky@unive.it
Centi	Gabriele	University of Messina and INSTM/CASPE, Dipartimento di Chimica Industriale ed Ingegneria dei Materiali, V.le F. Stagno D'Alcontres 31, 98166 Messina, Italy	centi@unime.it
Martorana	Antonino	Dipartimento di Chimica "Stanislao Cannizzaro", Università di Palermo, tel 0039 091 23897953, fax 0039 091 427584	antonino.martorana@unipa.it
Giannici	Francesco	Dipartimento di Fisica e Chimica Università di Palermo, Viale delle Scienze, I-90128 Palermo (Italy)	francesco.giannici@unipa.it
Turnes Palomino	Gemma	Department of Chemistry, University of the Balearic Islands, Cra. de Valldemossa, km 7.5, Palma de Mallorca, E-07122, Spain	g.turnes@uib.es
Venezia	Anna Maria	Istituto per Lo Studio dei Materiali Nanostrutturati (ISMN)-CNR via Ugo La Malfa, 153, 90146 Palermo, Italy	venezia@pa.ismn.cnr.it
Liotta	Leonarda	Istituto per Lo Studio dei Materiali Nanostrutturati (ISMN)-CNR via Ugo La Malfa, 153, 90146 Palermo, Italy	leonarda.liotta@ismn.cnr.it
Corrias	Anna	School of Physical Sciences, Ingram Building, University of Kent, Canterbury, UK	a.corrias@kent.ac.uk
Manzoli	Maela	Department of Chemistry, Torino University, Via Giuria 7, I-101025 Torino, Italy	maela.manzoli@unito.it
Borfecchia	Elisa	Department of Chemistry, Torino University, Via Giuria 7, I-101025 Torino, Italy	elisa.borfecchia@gmail.com

Bordiga	Silvia	Department of Chemistry, Torino University, Via Quarello 15, I-10135 Torino, Italy	silvia.bordiga@unito.it
Gropo	Elena	Department of Chemistry, Torino University, Via Quarello 15, I-10135 Torino, Italy	elena.gropo@unito.it
Martra	Gianmario	Department of Chemistry, Torino University, Via Giuria 7, I-101025 Torino, Italy	Gianmario.martra@unito.it
Berlier	Gloria	Department of Chemistry, Torino University, Via Giuria 7, I-101025 Torino, Italy	gloria.berlier@unito.it
Truccato	Marco	Department of Physics, Torino University, Via Giuria 1, I-101025 Torino, Italy	truccato@to.infn.it
Mino	Lorenzo	Department of Physics, Torino University, Via Giuria 1, I-101025 Torino, Italy	lorenzo.mino@unito.it
Milanesio	Marco	Università del Piemonte Orientale "A Avogadro", Via Michel 11, 15100 Alessandria - Italy	marco.milanesio@unipmn.it
Giannini	Cinzia	Istituto di Cristallografia, Consiglio Nazionale delle Ricerche, Via. Amendola 122/O, 70126 Bari - Italia, tel: +39 080 5929167	cinzia.giannini@ic.cnr.it
Di Cicco	Andrea	Physics Division - School of Science and Technology, University of Camerino, Italy, via Madonna delle Carceri, 62032 Camerino, Italy	andrea.dicicco@unicam.it
Gross	Silvia	Dipartimento di Scienze Chimiche, Università degli Studi di Padova, Via Marzolo 1, 35131 Padova, Italy	silvia.gross@unipd.it
Pollesel	Paolo	Eni spa, Research and Technological Innovation, Via Maritano 26, 20097 San Donato Milanese, Tel.: 02 52032353	paolo.pollesel@eni.com
Albonetti	Stefania	Alma Mater Studiorum - Bologna University Department of Industrial Chemistry "Toso Montanari" Viale Risorgimento, 4 - 40136 Bologna Phone: +39 051 2093681	stefania.albonetti@unibo.it
Urakawa	Atsushi	Group Leader, Institute of Chemical Research of Catalonia (ICIQ), The Barcelona Institute of Science and Technology, Av. Paisos Catalans 16, 43007 Tarragona, Spain, Phone +34 977 920 810, Fax +34 977 920 224	aurakawa@iciq.es
Malizia	Federica	Basell Poliolefine Italia S.r.l., 'Giulio Natta' Research Center, Piazzale G. Donegani 12 (cp 113), 44100 Ferrara Italy	Federica.Malizia@lyondellbasell.com
Gervasini	Antonella	Dipartimento di Chimica, Università di Milano, Via Golgi, 19, 20133 - Milano (Italy)	antonella.gervasini@unimi.it
Tronconi	Enrico	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	enrico.tronconi@polimi.it
Forzatti	Pio	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	pio.forzatti@polimi.it
Lietti	Luca	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	luca.lietti@polimi.it

Groppi	Gianpiero	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	gianpiero.groppi@polimi.it
Beretta	Alessandra	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	alessandra.beretta@polimi.it
Nova	Isabella	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	isabella.nova@polimi.it
Castoldi	Lidia	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	lidia.castoldi@polimi.it
Maestri	Matteo	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	matteo.maestri@polimi.it
Visconti	Carlo Giorgio	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	carlo.visconti@polimi.it
Donazzi	Alessandro	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	alessandro.donazzi@polimi.it
Matarrese	Roberto	<u>Laboratory of Catalysis and Catalytic Processes, www.lccp.polimi.it, Dipartimento di Energia, Politecnico di Milano, Via La Masa 34, 20156 Milano, Italy</u>	roberto.matarrese@polimi.it
Cutrufello	Giorgia	Dipartimento di Scienze Chimiche e Geologiche, Università di Cagliari, Complesso Universitario di Monserrato, s.s. 554 bivio per Sestu, 09042 Monserrato (Ca), Italy, tel. +39 070 675 4407/4423, fax +39 070 675 4388	gcutrufe@unica.it
Lorentsen	Odd-Arne	Yara International ASA (Norway)	odd-arne.lorentsen@yara.com
Waller	David	Yara International ASA (Norway)	david.waller@yara.com
Kvisle	Steinar	INOVYN Norge AS (Norway), Director of Technology and Production Support	steinar.kvisle@inovyn.com
Axelsen	Lars	Dynea, General Manager, Technology Sales & Licencing, Global, Tel: +47 90892856	lars.axelsen@dynea.com
Pedersen	Terje	KA Rasmussen (Norway)	terje.pedersen@karasmussen.com
Jörg	Radnik	Leibniz Institute for Catalysis at the University of Rostock Albert-Einstein-Str. 29a, D-18059 Rostock, Germany	Joerg.Radnik@catalysis.de
Brückner	Angelika	Head of Department "Catalytic in situ-Studies", University of Rostock, Albert-Einstein-Str. 29a, D-18059 Rostock, Germany	Angelika.Brueckner@catalysis.de

Frahm	Ronald	Bergische Universität Wuppertal, Fachbereich C – Physik, Gebäude U, Ebene 8, Gaußstraße 20, 42119 Wuppertal, Germany, Tel.: +49 (0)202 439-3100	frahm@uni-wuppertal.de
Müller	Oliver	University Wuppertal, Department of Physics, Wuppertal, Germany	o.mueller@uni-wuppertal.de
Lützenkirchen-Hecht	Dirk	University Wuppertal, Department of Physics, Wuppertal, Germany	dirklh@uni-wuppertal.de
Haumann	Michael	Freie Universität Berlin, FB Physik, Arnimalle 14, 14195 Berlin, Germany	michael.haumann@fu-berlin.de
Roldan Cuenya	Beatriz	Ruhr-University Bochum, Institute for Experimental Physics IV, Building NB 4/125, Universitätsstraße 150, 44801 Bochum, Germany	Beatriz.Roldan@rub.de
Weimar	Udo	University Tübingen, Institut für Physikalische und Theoretische Chemie, Auf der Morgenstelle 15, 72076 Tübingen, Germany	upw@ipc.uni-tuebingen.de
Barsan	Nicolae	University Tübingen, Institut für Physikalische und Theoretische Chemie, Auf der Morgenstelle 15, 72076 Tübingen, Germany	nb@ipc.uni-tuebingen.de
Muhler	Martin	University Bochum, Laboratory of Industrial Chemistry, Universitätsstraße 150, 44801 Bochum	muhler@techem.ruhr-uni-bochum.de
Strunk	Jennifer	Research Group Leader "Nanobased Heterogeneous Catalysts" (NanoCat) Max-Planck-Institute for Chemical Energy Conversion, Mülheim a.d. Ruhr, and Center for Nanointegration Duisburg-Essen, Germany	jennifer.strunk@cec.mpg.de
Bauer	Matthias	Universität Paderborn, Naturwissenschaftliche Fakultät, Department Chemie, Warburger Straße 100, 33098 Paderborn, Germany	matthias.bauer@upb.de
Widmann	Daniel	Institut für Oberflächenchemie und Katalyse, Universität Ulm, Germany	daniel.widmann@uni-ulm.de
Abdel-Mageed	Ali	Institut für Oberflächenchemie und Katalyse, Universität Ulm, Germany	ali.abdel-mageed@uni-ulm.de
Bansmann	Joachim	Institut für Oberflächenchemie und Katalyse, Universität Ulm, Germany	joachim.bansmann@uni-ulm.de
Behm	R. Jürgen	Institut für Oberflächenchemie und Katalyse, Universität Ulm, Germany	juergen.behm@uni-ulm.de
Kramm	Ulrike I.	TU Darmstadt, Jovanka-Bontschits-Str. 2, 64287 Darmstadt, Germany, phone: +49-6151-16 20356, fax: +49-6151-16 25671	kramm@ese.tu-darmstadt.de
Özaslan	Mehtap	Carl von Ossietzky University of Oldenburg, School of Mathematics and Science, Department of Chemistry, 26111 Oldenburg, Germany	mehtap.oezaslan@uni-oldenburg.de
Roth	Christina	Freie Universität Berlin, FB Biologie, Chemie, Pharmazie, Physikalische und Theoretische Chemie, Takustr. 3, D-14195 Berlin, Germany	christina.roth@fu-berlin.de
Albers	Peter	Head of Electron Microscopy / Surface Analysis, Product Line Analytik, Evonik Technology & Infrastructure GmbH, 915 D115, Rodenbacher Chaussee 4, 63457 Hanau-Wolfgang, Germany	Peter.albers@aqura.de
DeBeer	Serena	Max-Planck-Institut fuer Chemische Energiekonversion, Stiftstr. 34-36, D-45470 Mülheim an der Ruhr, Germany	serena.debeer@cec.mpg.de

Muddada	Naresh	SOLVAY Research and Innovation, Technology Development, 3966, Jin Du road- 2001108 Shanghai, Tel: +86 021 240 89 310 - M: +86 185 16 04 2931	naresh.muddada@solvay.com
Lamberti	Carlo	Torino University, Department of Chemistry (Italy) & Southern Federal University, Rostov-on-Don (Russia)	carlo.lamberti@unito.it