Letter of Intent

to submit a proposal for a Cluster of Excellence

# General Instructions

The Letters of Intent of the universities to submit proposals for a Cluster of Excellence are non- binding, are not reviewed and only serve to plan the review process.

Submission is requested

* for renewal proposals: by **4 pm** on **29 January 2024**.
* for establishment proposals: by **4 pm** on **15 April 2024**.

The information contained is preliminary and may differ from the actual proposal.

Please use the following template for the Letter of Intent, delete the instructions (in grey font) and convert the document to PDF format. Create a PDF file without password protection and without restrictions regarding reading, copying and printing. The PDF should be submitted via elan as “correspondence” regarding the draft proposal/establishment proposal, respectively. Please note that Letters of Intent can only be submitted by the spokespersons.

# Submission of the Letter of Intent via elan:

* + Please log in to your elan account. Only the spokesperson(s) can submit the Letter of Intent.
	+ Select “*Proposal Submission*” - “*Proposal Overview/Renewal Proposal*”.
	+ Search for the Cluster of Excellence (draft) proposal in the list and select “*Continue*”.
	+ Click the button next to “*Form for submitting comments, inquiries and additions to the DFG Head Office*” to start the online form.
	+ Upload the Letter of Intent as a PDF file and select “*Continue*”.
	+ Select “*Send*” to send the form to the DFG Head Office.
	+ You will be provided with a PDF summary of your submitted form for download and you will receive an automatic confirmation e-mail.

# Letter of Intent to submit a proposal for a Cluster of Excellence

1. **Proposal Type**

[ ]  New proposal

Reference number of draft proposal: **EXC 3 /0**

[x]  Renewal proposal

Reference number of establishment proposal: **EXC 2186/1**

# Title in German and English

The Integrated Fuel & Chemical Science Center
Adaptive Umwandlungssysteme für erneuerbare Energieträger und Chemikalien

The Integrated Fuel & Chemical Science Center
Adaptive Conversion Systems for Sustainable Energy Carriers and Chemicals

# Applicant university/universities and spokesperson(s)

|  |
| --- |
| Managing University |
| RWTH Aachen University |

# Spokesperson(s)

|  |  |
| --- | --- |
| Authorised spokesperson at the Managing University | Prof. Dr.-Ing. (USA) Stefan Pischinger |

|  |  |
| --- | --- |
| Further spokesperson(s) | Institution |
| Prof. Dr. rer. nat. Walter Leitner | RWTH Aachen UniversityMax Planck Institute for Chemical Energy Conversion |

# Participating Institutions

|  |  |
| --- | --- |
| Participating institutions | Location |
| Forschungszentrum Jülich (FZJ) | Jülich |
| Max Planck Institute for Chemical Energy Conversion | Mülheim a.d.R. |

# Summary of the Proposal

Since the mid 20th century, crude oil and natural gas have “fueled” the Anthropocene – literally through production of liquid energy carriers for mobility and transportation as well as by providing the crucial feedstock of carbon and hydrogen for the chemical value chain. Despite world-wide efforts to reduce the associated greenhouse gas emissions, the demand for crude oil is predicted to reach an all-time high exceeding the gigantic production of 100 barrel per day in the coming years. The scenarios for the reduction towards net-zero GHG-emissions comprise a range of measures centered around the global availability of renewable energy. The resulting **de-fossilization of the energy system** imposes challenges and opportunities for **the sectors mobility/transportation and chemistry** where direct electrification is difficult or even impossible due to the indispensable need for carbon. Shaping a post-fossil area at the interface of energy and chemistry therefore requires novel research concepts and breakthroughs in fundamental science as basis for disruptive technologies that will result in major societal and economic transformations.

In the context of this dynamic development of utmost importance for a sustainable future, **The Integrated Fuel & Chemical Science Center (FSC²) generates fundamental knowledge and novel scientific methods for the development of adaptive technical solutions to valorize renewable electricity and feedstocks into liquid energy carriers and chemicals in a systems approach**. RWTH Aachen University (RWTH) and its strategic partners Forschungszentrum Jülich (FZJ) and Max Planck Institute for Chemical Energy Conversion (MPI CEC) take an integrated approach to encompass their competencies on the molecular, device, and systems level to understand, master, and design sustainable processes to harness renewable energy in chemical energy carriers and products.



Figure 1: Vision of FSC² „The Integrated Fuel & Chemical Science Center generates fundamental knowledge and novel scientific methods for the development of adaptive technical solutions to valorize renewable electricity and feedstocks into liquid energy carriers and chemicals in a systems approach”

FSC² has its roots in the CoE Tailor-made Fuels from Biomass (TMFB) at RWTH Aachen. A unique interdisciplinary collaboration was established between combustion engineering, chemical engineering, chemistry, and biology using the intricate relation between combustion properties and the molecular structure of advanced bio-based fuels as common denominator. By strategic development of projects and structural measures, a fundamental understanding of „fuel design“ was successfully established for the first time. The subsequent CoE, The Fuel Science Center (FSC) was able to establish the broader field of „fuel science“ internationally by overcoming disciplinary borders through composing the extended expertise of the network in interdisciplinary Competence Areas according to the time- and length-scales of the *molecular*, *device*, and *systems* level. While carbon-based fuels were still at the center of the research activities, their application in advanced engine technologies and their „bio-hybrid“ production based on biomass as well as CO2 as alternative carbon sources could thus be envisaged. Expanding the research topics beyond the technosphere identified *adaptivity* as important design criteria to cope with the dynamics and variations in energy and feedstock supply at the interface between the energy and chemistry sectors.

The successfully established concept of interdisciplinary Competence Areas (CAs) and their effective and dynamic interconnection now form the backbone of the **unique research framework of The Integrated Fuel & Chemical Science Center (FSC²) to address adaptively the challenges resulting from the “defossilization” of energy carriers and chemicals**. All research activities and projects are allocated within **Strategic Research Areas (SRAs)** where they absorb and *vice versa* stimulate the disciplinary progress of the individual PIs, thus constantly augmenting the CAs. With the specific infrastructure of the partner institutions and the scientific profiles of the involved PIs, FSC² is ideally positioned to align groundbreaking science with focal technology options for post-fossil molecular energy carriers and products. **Continuing efforts** will be devoted to **fuel design** for low-carbon and low-emission **liquid energy carriers**. **Ammonia is now included** as molecular energy carrier and chemical building block. In addition to thermal combustion, **electro-chemical devices** **for recuperation of the chemical stored energy** are being studied. The **chemical value chain is addressed explicitly** as major area of application for the novel synthetic pathways and catalytic processes. **Analysis on a systems level** is developed as integrative part **to provide design criteria for sustainability and resilience**.

The Strategic Research Areas for FSC² will address the following key questions originating from the vision and mission outlined above:

* *How can global energy and material cycles be made* ***adaptive and resilient****, while fulfilling all three dimensions of sustainability -* ***ecological, economic and social****?*Current research often focuses on individual aspects of fuel and chemical conversion systems, e.g., individual levels of the system, or certain aspects of sustainability. Moreover, disruptions to the systems' supply and operation are often neglected, and the dynamics of the ongoing long-term transformation towards climate-neutrality are not sufficiently covered. Therefore, there's a need for an integrated approach to design and operate these systems to be both resilient to withstand and quickly recover from disruptions, and adaptive to adjust to variability in supply and demand and long-term transformation processes. The approach must encompass all dimensions of sustainability at every level, from individual processes to the broader supply chain and system level.
* *How can* ***translational catalytic processes*** *at the direct interface of energy and feedstocks be designed to cope with the dynamics and variations of their supply?*
In current catalysis research on renewable carbon feedstocks, there is a strong focus on developing novel transformations often using simple and pure model compounds. However, an envisaged process requires the additional fulfilment of certain catalyst performance criteria in terms of activity, selectivity and stability when dealing with real starting materials. Solvents and reactants characteristics need to be integrated with downstream processing and product isolation to achieve minimal energy use and environmental footprint.
* *How does the molecular structure of* ***carbon-based fuels*** *impact on efficiency and emissions upon recuperation of the chemically stored energy in backward-compatible thermal or future electrical propulsion systems?* In the current phase, all degrees of freedom of bio-hybrid fuel molecules and molecularly controlled combustion systems were exploited to achieve the highest possible efficiency with near-to-zero pollutant emissions. The task now is to transfer this knowledge to the optimization of existing propulsion systems with the associated tight constraints regarding possible modifications. Research into electro-chemical energy conversion is currently focused almost exclusively on hydrogen as an energy carrier. Here, the potential of direct liquid fuel cells is now to be unlocked through the integrated Fuel Design Process established by FSC.
* *How can engines and devices be designed to exploit* ***ammonia as fuel*** *most effectively?* Ammonia’s low reactivity and its tendency to form oxides of nitrogen pose major challenges to achieving high energetic efficiency and low emissions in thermochemical utilization. Solutions will be developed combining the molecular-torch concept with utilizing partial in-process reforming to hydrogen and innovations in exhaust-gas aftertreatment specifically for the very potent greenhouse gas N2O
* *How can chemical, biochemical, and electrochemical transformations for the manipulation of C-O and C-N bonds be interlinked to open* ***concatenated synthetic pathways*** *to fuels and chemicals?* The transformations of bio-based, C1 and N1 building blocks are usually addressed by the individual catalysis disciplines of molecular, heterogeneous, electro- or bio-catalysis. To establish effective connections between starting materials and desired molecular architectures, however, the transformation steps need to be designed and developed with a focus on the transfer points of intermediate products, reaction media and the recycling of the catalyst system from the beginning. Therefore, the selection of the most appropriate catalytic discipline is not determined solely by the evaluation of the individual catalytic transformation, but rather by the most efficient contribution within a transformation cascade of concatenated catalytic steps.

The SRAs are bridged via general design challenges that will be addressed in flexible working groups as the research program develops. This includes for example the integration of production pathways and propulsion properties for the C-based fuel design, the fundamental mechanisms of electrochemical ammonia activation for energy or synthetic applications, as well as the seemingly contradicting goals of integration for process chains and flexibility of individual process steps. A common platform for the scientific exchange and continuous adjustment of the overall research program in light of its mission and vision is provided in the **Systems Design Forum**, where the progress of the five SRAs and the working groups is biannually reported and discussed.

The 25 core PIs represent the three CAs and define the thematic focus within the SRAs. The project work is, however, based on a much larger network of scientific excellence and methodological expertise through about 15 associated PIs. All PIs have the same rights and responsibilities within the Cluster, creating the necessary critical mass and structural impact among the partner institutions. The resulting flexibility ensures continuing rejuvenation of the network of PIs including strategic appointments and early succession models. A major component are the support of early career academics opening new career paths across the institutional landscape.

Figure 2: The integrated framework of the five Strategic Research Areas (SRAs) embedded within the Competence Areas (CAs)

# Principal Investigators

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Principal investigators | Location/Institution | Field of expertise | Position |
| 1 | Jun.-Prof. Dr. phil. Katrin Arning | Aachen, RWTH | Risk Perception and Communication | W2/tenure track |
| 2 | Prof. Dr.-Ing. Dipl.-Wirt.Ing. Niklas von der Aßen | Aachen, RWTH | Technical Thermodynamics | W3/permanent |
| 3 | Prof. Dr.-Ing. Lars M. Blank | Aachen, RWTH | Applied Microbiology | W3/permanent |
| 4 | Prof. Dr. rer. nat. habil. Rüdiger Eichel | Jülich, FZJ | Fundamental Electrochemistry | W3/permanent |
| RWTH | Material and Process of Electrochemical Energy Storage and Conversion |
| 5 | Prof. Dr. rer. nat. Kathrin Greiff | Aachen, RWTH | Anthropogenic Material Cycles | W3/permanent |
| 6 | Prof. Dr. rer. nat. Sonja Herres-Pawlis | Aachen, RWTH | Bioinorganic Chemistry | W3/permanent |
| 7 | Prof. Dr.-Ing. Karl Alexander Heufer | Aachen, RWTH | High Pressure Gas Dynamics | W3/permanent |
| 8 | Prof. Dr.-Ing. Andreas Jupke | Aachen, RWTH | Fluid Process Engineering | W3/permanent |
| 9 | Prof. Dr. rer. nat. Jürgen Klankermayer | Aachen, RWTH | Translational Molecular Catalysis | W3/permanent |
| 10 | Prof. Dr. rer. nat. habil. Lars Lauterbach | Aachen, RWTH | Synthetic Microbiology  | W2/permanent |
| 11 | Prof. Dr. rer. nat. Walter Leitner | Aachen, RWTH | Technical Chemistry and Petrochemistry | W3/permanent |
| Mühlheim a.d.R., MPI CEC | Molecular Catalysis |
| 12 | Prof. Dr. techn. Karl Mayrhofer | Erlangen, FZJ | Electrocatalysis  | W3/permanent |
| 13 | Prof. Dr. rer. nat. Anna Mechler | Aachen, RWTH | Electrochemical Reaction Engineering | W2/temporary |
| 14 | Prof. Alexander Mitsos, Ph.D. | Aachen, RWTH | Process Systems Engineering | W3/permanent |
| Jülich, FZJ | Energy Systems Engineering |
| 15 | Prof. Dr. rer. nat. Regina Palkovits | Aachen, RWTH | Heterogeneous Catalysis and Technical Chemistry | W3/permanent |
| Jülich, FZJ | Sustainable Hydrogen Economy |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Principal investigators | Location/Institution | Field of expertise | Position |
| 16 | Prof. Dr.-Ing. (USA) Stefan Pischinger | Aachen, RWTH | Thermodynamics of Mobile Energy Conversion Systems | W3/permanent |
| 17 | Prof. Dr.-Ing. Heinz Pitsch | Aachen, RWTH | Combustion Technology | W3/permanent |
| 18 | Prof. Dr. rer. nat. Dörte Rother  | Jülich, FZJ | Synthetic Enzyme Cascades | W2/permanent |
| 19 | Prof. Dr. rer. nat.Franziska Schoenebeck | Aachen, RWTH | Organic Chemistry | W3/permanent |
| 20 | Prof. Dr. phil. Carmen Leicht-Scholten | Aachen, RWTH | Gender and Diversity in Engineering | W3/permanent |
| 21 | Prof. Dr. rer. nat. Ulrich Simon | Aachen, RWTH | Inorganic Chemistry and Electrochemistry | W3/permanent |
| 22 | Prof. Dr. rer. nat. Siegfried R. Waldvogel | Mühlheim a.d.R., MPI CEC | Electrosynthesis | W3/permanent |
| 23 | Univ. Prof. Dr. rer. pol. Grit Walther | Aachen, RWTH | Operations Management | W3/permanent |
| 24 | Prof. Dr.-Ing. Matthias Wessling | Aachen, RWTH | Chemical Process Engineering | W3/permanent |
| 25 | Prof. Dr. rer. nat. Mirijam Zobel | Aachen, RWTH | Crystallography and X-Ray Spectroscopy | W3/permanent |

# Fields of Research

|  |  |
| --- | --- |
| No. | Fields of research |
| 1 | 403-02 Technische Chemie  |
| 2 | 404-01 Energieverfahrenstechnik |
| 3 | 404-02 Technische Thermodynamik |
| 4 | 403-01 Chemische und Thermische Verfahrenstechnik |
| 5 | 404-04 Strömungs- und Kolbenmaschinen |
| 6 | 321-01 Anorganische Molekülchemie - Synthese, Charakterisierung |
| 7 | 321-02 Organische Molekülchemie - Synthese, Charakterisierung |
| 8 | 204-01 Stoffwechselphysiologie, Biochemie und Genetik der Mikroorganismen |
| 9 | 112-03 Betriebswirtschaftslehre  |
| 10 | 111-02 Empirische Sozialforschung  |

# Key Methods and Models

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| No. | Method / Model |
| 1 | Chemical Synthesis and Molecular Systems |
| 2 | Multifunctional Catalyst Design |
| 3 | Electrochemistry and Electrocatalysis |
| 4 | Metabolic and Bioprocess Engineering |
| 5 | Multi-Scale Reactor Design |
| 6 | Fluid Dynamics and Reactive Flows |
| 7 | Process Systems Engineering |
| 8 | Combustion Science and Engineering |
| 9 | Exhaust Gas Aftertreatment Systems |
| 10 | Sustainability and Risk Assessment |

# Collaborations/Conflicts of Interest

|  |  |  |
| --- | --- | --- |
| No. | Collaboration partners | Location/Institution |
| 1 | Claire Adjiman | United Kingdom; Imperial College London |
| 2 | Kareem Ahmed | USA; Univ. Central Florida |
| 3 | Manfred Aigner | Germany; DLR |
| 4 | Paul Alivasatos | USA; University of California |
| 5 | Frédéric Allain | Switzerland; ETH Zürich |
| 6 | Mohamed R. E. Aly | Egypt; Port Said University |
| 7 | Paul Anastas | USA; Yale University |
| 8 | Jakob Andreasson | Czech Republic; ELI |
| 9 | Antonio Andreini | Italy; University Florence |
| 10 | Corina Andronescu | Germany; Univ. Duisburg-Essen |
| 11 | Ulf-Peter Apfel | Germany; RUB and UMSICHT |
| 12 | Markus Appel | France; ILL |
| 13 | Matthias Arenz | Switzerland; Universität Bern |
| 14 | Antonio Attili | United Kingdom; University of Edinburgh |
| 15 | Frank Atzler | Germany; TU Dresden |
| 16 | Alexander Auer | Germany; MPI KoFo |
| 17 | Ilka Axmann | Germany; Universität Düsseldorf |
| 18 | Adisa Azapagic | United Kingdom; The University of Manchester |
| 19 | Julien Bachmann | Germany; FAU Erlangen- Nürnberg |
| 20 | Michael Baldea | USA; TUTA |
| 21 | Marco Baratieri | Italy; Universität Bozen |
| 22 | André Bardow | Switzerland; ETH Zürich |
| 23 | Dirk Bartel | Germany; U Magdeburg |
| 24 | Frank Bauer | Germany; U Stuttgart |
| 25 | Matthias Bauer | Germany; Universität Paderborn |
| 26 | Andrea Beck | Germany; Universität Stuttgart |
| 27 | Tristan Becker | Germany; Technische Universität Dresden |
| 28 | Malte Behrens | Germany; Universität Kiel |
| 29 | Alexis Bell | USA; Energy Biosc. Institute |
| 30 | Ian H. Bell | USA; National Institute of Standards and Technology |
| 31 | Sarah BenAmor | Canada; University of Ottawa |
| 32 | Lorenz T. Biegler | USA; CMU |
| 33 | Pegah Bineshpour | Iran; College of Engineering |
| 34 | Fabrizio Bisetti | USA; University of Texas |
| 35 | Bastian Bloombach | Germany; TUM |
| 36 | Anja Böckmann | France; IBCP Lyon |
| 37 | André L. Boehman | USA; University of Michigan |
| 38 | Benjamin Böhm | Germany; TU Darmstadt |
| 39 | Dominik Bongartz | Belgium; KU Leuven |
| 40 | Joakim Bood | Sweden; Lund University |
| 41 | Uwe Bornscheuer | Germany; University Greifswald |
| 42 | Irina Borodina | Dänemark; DTU |
| 43 | Michael Bortz | Germany; Fraunhofer ITWM |
| 44 | Christian Bressler | Germany; XFEL |
| 45 | Stefanie Bröring | Germany; Ruhr-Universität Bochum |
| 46 | Bruno Bühler | Germany; UFZ |
| 47 | Esin Ilhan Caarls | The Netherlands; Eindhoven University |
| 48 | Liming Cai | China; Tongji University |
| 49 | M. Campanella | United Kingdom; University of London, Queen Mary |
| 50 | Campbell D. Carter | USA; Air Force Research Lab |
| 51 | André Casal Kulzer | Germany; Universität Stuttgart |
| 52 | Benoit Chachuat | United Kingdom; Imperial College London |
| 53 | Henry Chapman | Germany; CFEL |
| 54 | Athanasios Chatzitakis | Norway; Universität Oslo |
| 55 | George Chen | China; Tsinghua University |
| 56 | Peirong Chen | China; SCUT |
| 57 | Chang-Hyuck Choi | South Korea; Gwangju Institute of Science and Technology |
| 58 | E. Colacino | France; Université de Montpellier |
| 59 | Avelino Corma | Spain; Universidad de Valencia |
| 60 | Björn Corzilius | Germany; Rostock University |
| 61 | Francesco Creta | Italy; University of Rome |
| 62 | Gabriel J. Cuello | France; ILL |
| 63 | Alberto Cuoci | Italy; Politecnico di Milano |
| 64 | Henry Curran | Ireland; Galway University |
| 65 | Bassam Dally | Saudi Arabia; KAUST |
| 66 | Mara de Joannon | Italy; STEMS |
| 67 | Serena deBeer | Germany; Max Planck Institute for Chemical Energy Conversion |
| 68 | Dario R. Dekel | Israel; Technion |
| 69 | Uwe Deppenmeyer | Germany; Universität Bonn |
| 70 | Hyungrok Do | South Korea; Seoul National University |
| 71 | Linda Doerrer | USA; Boston University |
| 72 | Pascale Domingo | France; INSA Rouen |
| 73 | Libor Dostal | Czech Republic; Universität Pardubice |
| 74 | Andreas Dreizler | Germany; TU Darmstadt |
| 75 | Matthias Drieß | Germany; TU Berlin |
| 76 | Eliabeth Dütschke | Germany; Fraunhofer ISI |
| 77 | Birgitta Ebert | Australien; University of Queensland |
| 78 | Hellmut Eckert |  Brasil; Universidade de São Paulo |
| 79 | Helmut Eichlseder | Austria; TU Graz |
| 80 | Peter Eilts | Germany; TU Braunschweig |
| 81 | Suleyman Er | The The Netherlands; DIFFER |
| 82 | Andreas Erbe | Norway; Norwegian University of Science and Technology |
| 83 | Gerhard Erker | Germany; Westfälische Wilhelms-Universität Münster |
| 84 | Matthias Ernst | Switzerland; ETH Zürich |
| 85 | Erik Esche | Germany; TU Berlin |
| 86 | Bastian Etzold | Germany; Technische Universität Darmstadt |
| 87 | Roland Faller | USA; University of California |
| 88 | Tiziano Faravelli | Italy; Politecnico di Milano |
| 89 | Michael Feldbrügge | Germany; Universität Düsseldorf |
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| 91 | Ravi Fernandes | Germany; PTB |
| 92 | Federica Ferraro | Germany; TU Braunschweig |
| 93 | Anna Fischer | Germany; Albert-Ludwigs-Universität |
| 94 | Asja Fischer | Germany; Ruhr-Universität Bochum |
| 95 | Henry Fischer | France; ILL |
| 96 | B. Furman | Poland; Polish Academy of Sciences |
| 97 | Amparo Galindo | United Kingdom; Imperial College London |
| 98 | Hubert Gasteiger | Germany; Technische Universität München |
| 99 | Klaus-Peter Geigle | Germany; DLR Institute for Combustion Technology |
| 100 | Markus Geimer | Germany; KIT |
| 101 | Peter Gerlinger | Germany; DLR Institute for Combustion Technology |
| 102 | Uwe Gerstmann | Germany; Universität Paderborn |
| 103 | Johannes Gescher | Germany; TUHH |
| 104 | Abdulla Ghani | Germany; TU Berlin |
| 105 | Laurant Gicquel | France; CERFACS |
| 106 | Roger Gläser | Germany; Universität Leipzig |
| 107 | Guillermo Gosset | Mexico; Universidad Nacional Autónoma de México |
| 108 | Eirini Goudeli | Australia; University of Melbourne |
| 109 | William Green | USA; MIT |
| 110 | Temistocle Grenga | United Kingdom; Southhampton University |
| 111 | Stefan Grimme | Germany; University of Bonn |
| 112 | Juri Grin | Germany; MPI CPfS |
| 113 | Alon Grinberg Dana | Israel; Technion |
| 114 | Marcus Grünewald | Germany; University Bochum |
| 115 | Jan-Dierk Grunwaldt | Germany; KIT |
| 116 | Stéphane Guillouet | France; INSA Toulouse |
| 117 | Peter Güntert | Switzerland; ETH Zürich |
| 118 | Jens Gutzmer | Germany; Helmholtz-Zentrum Dresden-Rossendorf e. V. |
| 119 | I. Halasz | Croatia; Institut Ruđer Bošković |
| 120 | Fabien Halter | France; University of Orleans |
| 121 | Jan Hamaekers | Germany; Fraunhofer SCAI |
| 122 | Nils Hansen | USA; Sandia National Laboratories |
| 123 | Christian Hasse | Germany; TU Darmstadt |
| 124 | Marco Haumann | Germany; FAU |
| 125 | Stefan Hausberger | Austria; TU Graz |
| 126 | Rudolf Hausmann | Germany; Hohenheim |
| 127 | Michael Heere | Germany; TU Braunschweig |
| 128 | Santosh Hemchandra | India; IISc Bangalor |
| 129 | Gerald Henkel | Germany; Universität Paderborn |
| 130 | Andreas Herrmann | Germany; DWI |
| 131 | Saskia Heumann | Germany; MPI CEC |
| 132 | Jafar Heydari | Iran; College of Engineering |
| 133 | Simone Hochgreb | United Kingdom; Cambridge University |
| 134 | Jan Philipp Hofmann | Germany; TU Darmstadt |
| 135 | Henner Hollert | Germany; Goethe Universität |
| 136 | U. Holzgrabe | Germany; Institut für Pharmazie und Lebensmittelchemie |
| 137 | Kohsuke Honda | Germany; Osaka University |
| 138 | Ali Hosseinnia | Sweden; Lund University, |
| 139 | Nicole Huijts | The Netherlands; Universität Tvente |
| 140 | Graham Hutchings | United Kingdom; Cardiff University |
| 141 | Hong Im | Saudi Arabia; KAUST |
| 142 | Ivana Ivanovic-Burmacovic | Germany; Universität Erlangen |
| 143 | George Jackson | United Kingdom; Imperial College London |
| 144 | Ankit Jain | India; IIT Bombay |
| 145 | Roman Jambor | Czech Republic; Universität Pardubice |
| 146 | Johannes Janicka | Germany; TU Darmstadt |
| 147 | Frederic Jaouen | France; Université de Montpellier |
| 148 | Guhan Jayaraman | Indien; IIT Madras |
| 149 | Gunnar Jeschke | Switzerland; ETH Zürich |
| 150 | Jiuxing Jiang | China; Sun Yat-Sen University |
| 151 | Min Jiang | China; Nanjing Tech |
| 152 | Agnes Jocher | Germany; TU München |
| 153 | Bill Jones | United Kingdom; Imperial College;London |
| 154 | Matthew Jones | United Kingdom; University of Bath |
| 155 | Yiguang Ju | USA; Princeton |
| 156 | Klaus Jurkschat | Germany; Technische Universität Dortmund  |
| 157 | Sebastian Kaiser | Germany; Universität Duisburg-Essen |
| 158 | Jörn Kalinowski | Germany; Uni Bielefeld |
| 159 | Makbule Kandakoglu | Canada; Concordia University Montreal |
| 160 | Tina Kapser | Germany; Universität Paderborn |
| 161 | Jay Keasling | USA; University of California |
| 162 | Rhett Kempe | Germany; UBT |
| 163 | Andreas Kempf | Germany; Universität Duisburg-Essen |
| 164 | Berthold Kersting | Germany; University of Leipzig |
| 165 | Ioannis G. Kevrekidis | USA; JHWSE |
| 166 | Reza Kholgy | Canada; Carleton University |
| 167 | Rhadika Khosla | United Kingdom; University of Oxford |
| 168 | Markus Klein | Germany; Universität der Bundeswehr München |
| 169 | Wolfgang Kleist | Germany; TU Kaiserslautern |
| 170 | Stephen J. Klippenstein | USA; Argonne National Laboratories |
| 171 | Marius Kloft | Germany; TU Kaiserslauten |
| 172 | Axel Knop | Germany; FHI |
| 173 | C.R. (Bob) Koch | Canada; University of Alberta |
| 174 | Thomas Koch | Germany; Karlsruher Institut für Technologie |
| 175 | Norbert Kockmann | Germany; TU Dortmund |
| 176 | Oliver Koepler | Germany; TIB |
| 177 | Katharina Kohse-Höinghaus | Germany; Uni Bielefeld |
| 178 | Marc Koper | The Netherlands; Leiden University |
| 179 | Matthias Kraume | Germany; TU Berlin |
| 180 | Rainer Krull | Germany; Technische Universität Braunschweig |
| 181 | Dirk Kuckling | Germany; Universität Paderborn |
| 182 | Amit Kumar | Canada; University of Alberta |
| 183 | Georg Künze | Germany; Leipzig University Medical School |
| 184 | Josh Lacey | Belgium; KU Leuven |
| 185 | Martin Lambert | United Kingdom; Oxford Institut for Energy Studies |
| 186 | Oliver Lammel | Germany; DLR |
| 187 | Alexei Lapkin | United Kingdom; University of Cambridge |
| 188 | Gilbert Laporte | Canada; HEC Montréal |
| 189 | Vincent Le Chenadec | France; Gustave Eiffel University |
| 190 | Jay H. Lee | South Korea; KAIST |
| 191 | Silke Leimkühler | Germany; University Potsdam |
| 192 | Oliver Lenz | Germany; Technical University Berlin |
| 193 | Steffen Lindner-Mehlich | Germany; Charité |
| 194 | John Linkhorst | Germany; TU Darmstadt |
| 195 | Gregory T. Linteris | USA; NIST |
| 196 | Alfred Ludwig | Germany; Ruhr-Universität Bochum |
| 197 | Thomas Lunkenbein | Germany; FHI |
| 198 | Ulrich Maas | Germany; Karlsruhe Institute of Technology |
| 199 | Andreas Magerl | Germany; FAU |
| 200 | Detlef Markus | Germany; PTB |
| 201 | Holger Marschall | Germany; TU Darmstadt |
| 202 | Justus Masa | Germany; MPI CEC |
| 203 | Astrid Mass | Germany; Fraunhhofer SCAI |
| 204 | James Massey | United Kingdom; Cambridge University |
| 205 | R. McCulla | USA; Saint Louis University |
| 206 | Beat H. Meier | Switzerland; ETH Zürich |
| 207 | Wolfgang Meier | Germany; Institute for Combustion Technology |
| 208 | Lorenz Meinel | Germany; Universität Würzburg |
| 209 | Frank Meisel | Germany; Christian-Albrechts-Universität zu Kiel |
| 210 | Carsten Meyer | Germany; FAU Erlangen- Nürnberg |
| 211 | Vera Meyer | Germany; TU Berlin |
| 212 | Tatiana Minav | Finnland; Tampere University |
| 213 | Daniel Mira | Spain; Barcelona Supercomputing Center |
| 214 | Ruth Misener | United Kingdom; Imperial College London |
| 215 | Bruna Mota | Portugal; University of Lisbon |
| 216 | Micheal Mueller | USA; Princeton University |
| 217 | Kathryn Mumford | Australia; University of Melbourne |
| 218 | Venkat Narayanaswamy | USA; NC State University |
| 219 | Graham J. Nathan | Australia; University of Adelaide |
| 220 | Arian Nijmeijer | The Netherlands; Universität Tvente |
| 221 | Jens Noack | Germany; Universität der Bundeswehr München |
| 222 | Truls Norby | Norway; University of Oslo |
| 223 | Carrie Noren | USA; US Air Force |
| 224 | Jacqueline O’Connor | USA; Pennsylvania State University |
| 225 | Kevin O'Connor | Irland; UCD |
| 226 | Stephen Ojwach | South Africa; Univ. Kwazulu-Natal |
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| 228 | Daniel Pak | Germany; Universität Siegen |
| 229 | Jhon Pareja | Germany; DLR |
| 230 | Alessandro Parente | Belgium; Free University of Brussels |
| 231 | Caroline E. Paul | The Netherlands; TU Delft |
| 232 | Markus Pauly | Germany; TU Dortmund |
| 233 | Brian Pauw | Germany; BAM |
| 234 | Matteo Pelucchi | Italy; Politecnico di Milano |
| 235 | Felipe A. Perdomo | United Kingdom; Imperial College London |
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| 237 | GiovanniMaria Piccini | Italy; UNIMORE |
| 238 | Andrij Pich | Germany; DWI |
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| 241 | Martyn Poliakoff | United Kingdom; The University of Nottingham |
| 242 | Wolfgang Polifke | Germany; TU Munich |
| 243 | Ana Povoa | Portugal; University of Lisbon |
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| 245 | Martin Rabe | Germany; MPIE |
| 246 | Sujith Raman | India; IIT Madras |
| 247 | Prabhat Ranjan | The Netherlands; Maastricht University |
| 248 | Gintaras V. Reklaitis | USA; Purdue University |
| 249 | Renaldi Renaldi | United Kingdom; University of Oxford |
| 250 | Ortwin Renn | Germany; IASS |
| 251 | Jens U. Repke | Germany; TU Berlin |
| 252 | Jakob Rhyner | Germany; Universität Bonn |
| 253 | Markus Richter | Germany; Technische Universität Chemnitz  |
| 254 | Roland Riek | Switzerland; ETH Zürich |
| 255 | K. Rissanen | Finland; University of Jyväskylä |
| 256 | David Rival | Germany; Technische Universität Braunschweig |
| 257 | William L. Roberts | Saudi Arabia; KAUST |
| 258 | Yuri Roman | USA; Massachusetts Institute of Technology |
| 259 | Miriam Rosenbaum | Germany; Friedrich Schiller University  |
| 260 | Christine Rouselle | France; Université d'Orléans |
| 261 | Michael Rübhausen | Germany; Universität Hamburg |
| 262 | Sebastian Sager | Germany; Universität Magdeburg |
| 263 | S. Mani Sarathy | Saudi Arabia; KAUST |
| 264 | Philippe Sautet | USA; UCLA |
| 265 | Jordy Saya | The Netherlands; Maastricht University |
| 266 | Taraneh Sayadi | France; Sorbonne University |
| 267 | Thomas Scheibel | Germany; University of Bayreuth |
| 268 | Gerhard Schembecker | Germany; TU Dortmund |
| 269 | Viktor Scherer | Germany; RU Bochum |
| 270 | O. Scherf-Clavel | Germany; Ludwig-Maximilians-Universität München  |
| 271 | Christina Scheu | Germany; Max-Planck-Institut für Eisenforschung GmbH |
| 272 | Martin Schiemann | Germany; RU Bochum |
| 273 | Maximilian Schiffer | Germany; Technical University of Munich |
| 274 | Carsten Schilde | Germany; TU Braunschweig |
| 275 | Siegfried Schindler | Germany; JGU Gießen |
| 276 | Hans-Joachim Schmid | Germany; Universität Paderborn |
| 277 | Sandy Schmidt | The Netherlands; University of Groningen |
| 278 | Wolf-Gero Schmidt | Germany; Universität Paderborn  |
| 279 | Wolfgang Schuhmann | Germany; Ruhr-Universität |
| 280 | Thierry Schuller | France; IMFT |
| 281 | Christof Schulz | Germany; Universität Duisburg-Essen |
| 282 | Boelo Schuur | The Netherlands; University of Twente |
| 283 | Artur Schweidtmann | The Netherlands; TU Delft |
| 284 | Doris Segets | Germany; Univ. Duisburg-Essen |
| 285 | Jürgen Senker | Germany; UBT |
| 286 | Jose Serra | Spain; University of Valencia |
| 287 | Yang Shao-Horn | USA; Massachusetts Institute of Technology |
| 288 | Michael Siegrist | Switzerland; ETH Zürich |
| 289 | Alexandre Simonov | Australia; Monash University Australia |
| 290 | Aaron Skiba | USA; Air Force Research Lab |
| 291 | Mirko Skiborowski | Germany; SVT;TU Hamburg |
| 292 | Carson Slabaugh | USA; Purdue University |
| 293 | Irina Smirnova | Germany; TVT;TU Hamburg |
| 294 | Bart Somers | The Netherlands; TuE |
| 295 | Benjamin Sovacool | United Kingdom; University of Sussex |
| 296 | Evan Spruijt |  The Netherlands; Radboud University Nijmegen |
| 297 | T. Daniel P. Stack | USA; Stanford University |
| 298 | Dieter Stapf | Germany; Karlsruher Institut für Technologie |
| 299 | Linus Stegbauer | Germany; Uni Stuttgart |
| 300 | Oliver Stein | Germany; KIT |
| 301 | Christoph Steinbeck | Germany; Friedrich Schiller University  |
| 302 | Greg Stephanopoulos | USA; Massachusetts Institute of Technology |
| 303 | Michael Stohr | Germany; DLR Institute for Combustion Technology |
| 304 | Peter Strasser | Germany; Technische Universität Berlin |
| 305 | Elena Sturm | Germany; LMU |
| 306 | Qiming Sun | China ; Soochow University |
| 307 | Bernadette Sütterlin | Switzerland; ZHAV School of Engineering |
| 308 | Nedunchezhian Swaminathan | United Kingdom; Cambridge University |
| 309 | Ralf Takors | Germany; Uni Stuttgart |
| 310 | Juha Tanskanen | Finland; University of Oulu |
| 311 | Edson Ticianelli | Brasil; University of São Paulo |
| 312 | Milana Trifkovic | Canada; Univ. of Calgary |
| 313 | Philipp Trotter | Germany; University of Wuppertal |
| 314 | Angelos Tsoukalas | The Netherlands; Erasmus University Rotterdam |
| 315 | Roland Ulber | Germany; TU Kaiserslautern |
| 316 | K. Užarević | Croatia; Institut Ruđer Bošković |
| 317 | Gerald van den Boogart | Germany; Helmholtz-Institut Freiberg für Ressourcentechnologie |
| 318 | Adri van Duin | USA; PennState University |
| 319 | Toon Verstraelen | Belgium; University of Ghent |
| 320 | Luc Vervisch | France; INSA Rouen |
| 321 | Kylie Vincent | United Kingdom; University of Oxford |
| 322 | Venkat Viswanathan | USA; Carnegie Mellon University |
| 323 | Birgit Vogel-Heuser | Germany; TU München |
| 324 | Xinfang Wang | United Kingdom; University of Birmingham |
| 325 | Peter Wasserscheid | Germany; FAU |
| 326 | Hiroaki Watanabe | Japan; Fukuoka Unviersity |
| 327 | Birgit Weber | Germany; Universität Bayreuth |
| 328 | Jürgen Weber | Germany; TU Dresden |
| 329 | Bert Weckhuysen | The Netherlands; Universität Utrecht |
| 330 | Michael Wensing | Germany; FAU Erlangen- Nürnberg |
| 331 | Charles Westbrook | USA; University of California |
| 332 | Nikolas Wöhrl | Germany; Univ. Duisburg-Essen |
| 333 | Martin Wollschläger | Germany; TU Dresden |
| 334 | Martien A. Wurdemann | The Netherlands; Maastricht University |
| 335 | Rolf Wüstenhagen | Switzerland; University of St. Gallen |
| 336 | Jia-Yue Yang | China; Shandong University |
| 337 | Daiqi Ye | China; SCUT |
| 338 | Zhiyao Yin | Germany; DLR |
| 339 | Manzil Zaheer | USA; Google Research |
| 340 | Dzmitry Zaitsau | Germany; University of Rostock |
| 341 | Tao Zhang | China; Dalian Institute of Chemical Phsysics |

# Persons who are to be excluded from the Review Panel

not applicable

# Signatures

|  |  |
| --- | --- |
| place and date | signature |
|  | name(Authorised spokesperson of the managing university) |
| place and date | signature |
|  | name(Rector / president of the managing university) |
| place and date | signature |
|  | name(Rector / president of other applicant universities) |
| place and date | signature |
|  | name(Rector / president of other applicant universities) |
| . |  |