COST
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MechSustInd

CA18112 Mechanochemistry for Sustainable Industry

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Mechanochemistry Meets Industry

February 17–18, 2021

SCAN ME

Book of Abstracts

Funded by the Horizon 2020 Framework Programme of the European Union

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European Chemical Society

EuChemS European Chemical Society

COST EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

MechSustInd

Mechanochemistry Meets Industry

Free Event

February 17-18, 2021 – Online & Live

"*Mechanochemistry for Sustainable Industry*" - www.mechsustind.eu - **COST Action CA18112** - strives to advance cooperation between industrial partners and academic researchers to facilitate integration of mechanochemistry into chemical processes at both R&D phase and production scale.

February 17, 2021 - Afternoon Session (2:00 - 5:00 pm CET)

Tomislav FRIŠČIĆ (McGill University, Canada)
Emergence of medicinal mechanochemistry: from DNA to co-crystals and back

Paolo FILIPPONI (Novartis Basel, Switzerland)
Continuous flow process design as a blueprint for reactive extrusion process development

James MACK (Univ. of Cincinnati, USA) & Joel ANDERSEN (CinthesisSolutions, USA)
Mechanochemistry: The Why, The How, and the Scale-up

Martin VIERTELHAUS (BASF, Germany)
Mechanochemistry for Pesticide Formulation – Co-Crystals by Milling

February 18, 2021 - Morning Session (9:00 am - 1:00 pm CET)

Deborah CRAWFORD (University of Bradford, UK)
Developments in the Scale-up of Mechanochemical Synthesis

Valerio ISONI (A-Star, Singapore)
Development and scale up of an exothermic reduction in a continuous granulator

José CASABAN (MOF Technologies, UK)
Mechanochemical synthesis of Metal Organic Frameworks: from lab scale to commercial quantities

Maria Elena RIVAS-VELAZCO (Johnson-Matthey, UK)
Understanding the mechanochemical synthesis of mixed metal oxide materials

February 18, 2021 - Afternoon Session (2:00 pm - 5:00 pm CET)

Tanja BENDELE (Ruhr IP, Germany)
Patents - possibilities and problems –focusing on mechanochemistry for sustainable industry

Helmut BUSCHMANN & Norbert HANDLER (RD&C Research, Devel. & Consulting GmbH, Austria)
Pharmaceutical Applications in Mechanochemistry

John WARNER (Zymergen, USA)
The historic relationship between mechanochemistry and green chemistry

PANEL DISCUSSION – The future is now

MEET THE SPEAKERS DURING THE VIRTUAL COFFEE BREAKS, ATTEND THE PANEL DISCUSSION, AND MORE…

The detailed program is available in the agenda at ***www.mechsustind.eu***

SAVE the DATE and JOIN US !

Please register for the live and free event here*: http://bit.ly/38jlllj

** A link to connect will be sent to the registered participants 24 h before the start of the workshop.*

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Mechanochemistry for Sustainable Industry

The COST Action CA18112 “Mechanochemistry for Sustainable Industry” (MechSustInd) focuses on the great promise, and unexpressed potential, shown by Mechanochemistry within the contexts of chemical, pharmaceutical industries, and process engineering.

Organic mechanochemistry has been shown to enable the reduction, or the elimination, of solvents, while ensuring increased yields and scope of substrates compared to solution-phase synthesis, better crystallinity of final products, and access to products that can be formed only under mechanical activation conditions. This COST Action aims at establishing a multi-disciplinary network of European scientists, engineers, technologists, entrepreneurs, industrialists, and investors addressing the exploitation of mechanical activation in the production of chemicals through sustainable and economically convenient practices on the medium and large scales.

Specifically, this Action addresses the objective of harmonizing fundamental and applied research with technological innovation and industrial needs, representing the necessary step for enhancing the impact of mechanical processing onto organic synthesis and transferring specific knowledge into the industrial value chains. The Action aims to nucleate a critical mass of actors from EU research Institutions, enterprises and industries, bringing together different areas of expertise and application. The creation of an authoritative community to promote the study of mechanochemistry and encourage its utilization in production processes will catalyze strategic advances in European chemical industry. The favorable features of mechanically activated (organic) transformations is expected to enable the attainment of far-reaching objectives connected with the development of green economy, the improvement of European market competitors’ capabilities, the innovation of process engineering, and the growth of a new generation of specialized researchers.

Areas of Expertise Relevant for the Action

- Chemical sciences: Green chemistry research
- Chemical sciences: Sustainability
- Chemical engineering: Sustainable engineering
- Chemical sciences: Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions
- Chemical engineering: Process chemistry and technology

EuChemS

European Chemical Society

EuChemS, the European Chemical Society, aims to nurture a platform for scientific discussion and to provide a single, unbiased European voice on key policy issues in chemistry and related fields.

Representing more than 160,000 chemists from more than 40 Member Societies and other chemistry related organisations, EuChemS relies on a unique network of active researchers involved in all the fields of chemistry. Through this network, EuChemS organises several specialised academic conferences as well as the biannual EuChemS Chemistry Congress, the European congress of chemical sciences. EuChemS also promotes the role and image of the chemical sciences among the general public and policy-makers through social media, newsletters and through the organisation of conferences and workshops open to the society.

Through the promotion of chemistry and by providing expert and scientific advice, EuChemS aims to take part of the solution to today´s major societal challenges.

For more information about the European Chemical Society (EuChemS), please visit www.euchems.eu or contact us at:

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Mechanochemistry Meets Industry

Online and Live Workshop

February 17-18, 2021

Scientific Program

FEBRUARY 17 – *Afternoon Session* (2:00 – 5:00 pm, CET)

2:00 pm *Welcome opening remarks*
Evelina COLACINO (Université de Montpellier, France)

Chaired by Evelina COLACINO (Université de Montpellier, France)

2:10 pm *Emergence of medicinal mechanochemistry: from DNA to co-crystals and back*
Tomislav FRIŠČIĆ (McGill University, Canada).

2:40 pm *Continuous flow process design as a blueprint for reactive extrusion process development*
Paolo FILIPPONI (Novartis Basel, Switzerland).

2:10 pm *Join the breakout rooms:* **Room 1** (T. FRIŠČIĆ), **Room 2** (P. FILIPPONI), **Room 3** (Networking coffee break)

Chaired by Franziska EMMERLING (BAM Berlin, Germany)

3:30 pm *Mechanochemistry: the why, the how, and the scale-up*
James MACK (Univ. of Cincinnati, USA) & Joel ANDERSEN (CinthesisSolutions, USA)

4:00 pm *Mechanochemistry for pesticide formulation – co-crystals by milling*
Martin VIERTELHAUS (BASF, Germany)

4:30 pm *Join the breakout rooms:* **Room 1** (J. MACK & J. ANDERSEN), **Room 2** (M. VIERTELHAUS), **Room 3** (Networking coffee break).

4:50 pm *Closing remarks*
Evelina COLACINO and Franziska EMMERLING

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FEBRUARY 18 – *Morning Session* (9:00 am – 1:00 pm, CET)

9:00 am *Welcome opening remarks*
Felipe GARCIA (NTU, Singapore)

Chaired by Felipe GARCIA (NTU, Singapore)

9:10 am *Developments in the scale-up of mechanochemical synthesis*
Deborah CRAWFORD (University of Bradford, UK)

9:40 am *Development and scale-up of an exothermic reduction in a continuous granulator*
Valerio ISONI (A-Star, Singapore)

10:10 am *Join the breakout rooms:* **Room 1** (D. CRAWFORD), **Room 2** (V. ISONI), **Room 3** (Networking coffee break).

Chaired by Allan NIIDU (TalTech, Estonia)

10:30 am *Mechanochemical synthesis of Metal Organic Frameworks: from lab scale to commercial quantities*
José CASABAN (MOF Technologies, UK)

11:00 am *Understanding the mechanochemical synthesis of mixed metal oxide materials*
Maria Elena RIVAS-VELAZCO (Johnson-Matthey, UK)

11:30 am *Join the breakout rooms:* **Room 1** (J. CASABAN), **Room 2** (M.E. RIVAS-VELAZCO), **Room 3** (Networking coffee break)

11:50 am *Morning Session closing remarks*
Felipe GARCIA and Allan NIIDU

FEBRUARY 18 – *Afternoon Session* (2:00 pm – 5:00 pm, CET)

2:00 pm *Welcome opening remarks*
Chaired by Evelina COLACINO (Université de Montpellier, France)

Chaired by Evelina COLACINO (Université de Montpellier, France)

2:10 pm *Patents - Possibilities and Problems – focusing on mechanochemistry for sustainable industry*
Tanja BENDELE (RUHR IP, Patentwälte, Germany)

2:40 pm *Pharmaceutical applications in mechanochemistry*
Helmut BUSCHMANN & Norbert HANDLER (RD&C Research, Development & Consulting GmbH, Austria)

3:10 pm *The historic relationship between mechanochemistry and green chemistry*
John WARNER (Zymergen, USA)

3:40 pm *Join the breakout rooms:* **Room 1** (T. BENDELE), **Room 2** (H. BUSCHMANN and N. HANDLER), **Room 3** (J. WARNER), **Room 4** (Networking coffee break)

4:00 pm *Panel discussion*

5:00 pm *Concluding remarks*

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TOMISLAV FRIŠČIĆ

Tomislav Friščić is a Professor of Chemistry at McGill University. His group's work involves the development of mechanochemical and solvent-free chemistry in general, with the intention to provide reactions, technologies and concepts for cleaner, safer chemistry and manufacturing**.**

EMERGENCE OF MEDICINAL MECHANOCHEMISTRY: FROM DNA TO CO-CRYSTALS AND BACK

Department of Chemistry, McGill University, Canada
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Over the past decade, the development of mechanochemical techniques[1] has provided the first general route to conduct a wide range of chemical transformations in a solvent-free environment. At the same time, this development has also made accessible novel transformations, and enabled the observation and even the isolation of molecules and materials (cocrystals, salts, metal-organic frameworks) not obtained from solution chemistry.[2]
As a result, contemporary mechanochemistry offers a versatile toolbox of solvent-free transformations and synthetic/screening strategies that should be attractive and helpful to medicinal chemists and pharmaceutical scientists aiming to develop safer, cleaner syntheses of molecular targets without bulk solvents – with the added benefit of providing access to new reactivity that can shorten synthetic pathways and permit more efficient solid form screening.
This presentation outlines this recent and ongoing emergence of Medicinal Mechanochemistry[3] – mechanochemistry for the synthesis of active pharmaceutical ingredients (APIs) and screening for pharmaceutical solid forms.

References

1. James, S. L. *et al. Chem. Soc. Rev.* **2012**, *41*, 413.
2. Friščić, T. *et al. Angew. Chem. Int. Ed.* **2020**, *59*, 1018.
3. Tan, D. *et al. Chem. Commun.* **2016**, *52*, 7760.

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PAOLO FILIPPONI

Education

2013 - PhD at the University of Perugia. Med Chem Department. Prof. Pellicciari group

Professional experience

- 2013-2014 - Research associate at TES Pharma - *Synthetic routes development and scale-up*
- 2014-2016 - Post doc at the University of Durham. Prof. Ian Baxendale group - *Flow chemistry and innovative synthetic technologies*
- 2016-Present - Principal scientist in the Continuous Manufacturing Unit at Novartis (Basel) - *Development and modelling of continuous manufacturing processes*

CONTINUOUS FLOW PROCESS DESIGN AS A BLUEPRINT FOR REACTIVE EXTRUSION PROCESS DEVELOPMENT

Novartis Pharma AG, Switzerland
E-mail : paolo.filipponi@novartis.com

Flow chemistry and reactive extrusion share a common manufacturing concept and similar attributes. Both technologies enable the continuous processing of materials in a small and highly controlled environment. Furthermore, both approaches can be seen as a technical answer to the quest for more flexible, robust and sustainable synthetic processes. While flow chemistry is well established as a tool in the technology portfolio of pharma industries, reactive extrusion still requires efforts to assess the way toward the full implementation stage. Taking as example the experience of the Novartis Continuous Manufacturing team in Entresto, the workflow followed to scale-up a continuous reaction will be proposed as a model roadmap for the development of a reactive extrusion process. The identification of critical process parameters as well as the generation of accurate thermochemical data will be highlighted as mandatory prerequisites for a safe, efficient and robust scale-up. The practical aspects of these two key activities will be instrumental to share with the audience the potential challenges ahead toward the implementation of a reactive extrusion process at scale.

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JAMES MACK

James Mack is professor of chemistry at the University of Cincinnati After completing his Bachelor's degree at Middlebury College (1995), he was awarded a New England Board of Higher Education Scholarship and earned his doctoral degree at the University of New Hampshire. He was a postdoctoral fellow with Lawrence T. Scott and then joined the faculty as an Assistant Professor at the University of Cincinnati in 2003, was promoted to the rank of Associate Professor with tenure in 2009 and promoted to the rank of Professor in 2016. His research has been featured in the New York Times, Chemical and Engineering News, Chemistry and Industry and National Public Radio (US). In addition to his research accomplishments, he received recognition for his mentorship and service by both graduate and undergraduate students. More recently, he was appointed the Associate Dean of the Graduate School at the University of Cincinnati, overseeing over 300 graduate programs and over 11,000 graduate students.

MECHANOCHEMISTRY: THE WHY, THE HOW, AND THE SCALE-UP

University of Cincinnati, USA
E-mail: james.mack@uc.edu, Twitter : @mechanochemist,
Web: https://researchdirectory.uc.edu/p/mackje

Historically solvents have been believed to be an essential part of a chemical reaction; so much so that thought is rarely given to conducting a chemical reaction in its absence. Mechanochemistry via small (milligram to gram) batch reactors have created a new pathway to conduct traditional organic chemical reactions without a solvent. Twin-screw extruders and other large scale mixers have been identified to be able to conduct these novel reactions on an industrial scale. We have begun the process of learning about the relevant factors for transiting from small-scale milling to extrusion. Successful extrusion processes can allow for the generation of organic and inorganic materials in a cheaper, faster, safer, and more environmentally friendly manner.

References

1. Ortiz-Trankina, L.N.; Crain, J.; Williams, C.; Mack, J. *Green Chem.* **2020**, *22*, 3638.
2. Andersen, J.M.; Mack, J. *Chem. Sci.* **2017***, 8*, 5447.

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JOEL ANDERSEN

Joel Andersen received his PhD in organic chemistry stemming from deep research into mechanochemistry and he has an MS in Environmental Science & Engineering.

MECHANOCHEMISTRY: THE WHY, THE HOW, AND THE SCALE-UP

Cinthesis, USA
E-mail: Joel.Andersen@CinthesisSolutions.com, Web : http://www.CinthesisSolutions.com ;

Historically solvents have been believed to be an essential part of a chemical reaction; so much so that thought is rarely given to conducting a chemical reaction in its absence. Mechanochemistry via small (milligram to gram) batch reactors have created a new pathway to conduct traditional organic chemical reactions without a solvent. Twin-screw extruders and other large scale mixers have been identified to be able to conduct these novel reactions on an industrial scale. We have begun the process of learning about the relevant factors for transiting from small-scale milling to extrusion. Successful extrusion processes can allow for the generation of organic and inorganic materials in a cheaper, faster, safer, and more environmentally friendly manner.

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MARTIN VIERTELHAUS

Dr. Martin Viertelhaus is principal scientist at BASF SE with focus on polymorphism and crystalline materials. His main interest is in the solid-state landscape of small molecule active ingredients, solid state properties and their implications for e.g. production, storage, formulation and toxicology. He formerly worked in the solid-state department of Solvias and the physicochemistry department of Nycomed/Takeda.

MECHANOCHEMISTRY FOR PESTICIDE FORMULATION CO-CRYSTAL BY MILLING

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E-mail: martin.viertelhaus@basf.com

In agrochemical industry, crystalline active ingredients in solids containing formulations are milled to obtain small particles. If the active ingredient is formulated into a suspension concentrate the water-based formulation with its solid load needs to be freely flowable. It cannot show sedimentation upon storage and after dilution with water it needs to pass fine spray nozzles during field application.
The presented agrochemical formulation contains two active ingredients which form a co-crystal. The co-crystal shows improved properties compared to the individual active ingredients or to its mixture.

Liquid assisted grinding is part of co-crystal screening[1] and milling of a suspension is one of the final steps in the production of the formulation. Therefore, upscaling the co-crystal formation from a liquid assisted grinding screening experiment into a mechanochemical process is a combination of several steps: co-crystal formation, co-crystal milling, finishing of formulation with instant milling to the final required particle size.

References

1. Friščić, T.; Jones, W., chapter 8 in *Pharmaceutical Salts and Co-crystals*, RSC Drug Discovery Series No. 16, editors: J. Wouters and L. Quéré, **2012.**

DEBORAH E. CRAWFORD

Having obtained my MSci and PhD in Chemistry at Queen's University Belfast, I spent one year seconded into MOF Technologies Ltd. I was then appointed as a Postdoctoral Researcher to investigate synthesis by twin screw extrusion, of which I now have several years of experience. Currently, I am a Bio-Organic Lecturer in the School of Chemistry and Biosciences at the University of Bradford. My group's main research activity involves determining the bioactivity of mechanochemically prepared metallodrugs and investigating new technologies for solvent-free synthesis, including sonochemistry.

DEVELOPMENTS IN THE SCALE-UP OF MECHANOCHEMICAL SYNTHESIS

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We have demonstrated that twin screw extrusion (TSE) can be employed for the scale up of mechanochemical synthesis into a continuous, solvent-free process.[1] The excellent potential of extrusion has been demonstrated via the preparation of metal organic frameworks, deep eutectic solvents, and a library of organic compounds. Extrusion allows the preparation of these materials on a 6.5 $kghr^{-1}$ scale and the residence time is very short (2 minutes). Furthermore, Active Pharmaceutical Ingredients (APIs) have been successfully synthesised by extrusion[2] and they have been actively rendered amorphous by manipulation of the extrusion parameters. More recently, we have demonstrated the preparation of organic compounds of pharmaceutically relevant co-crystals by solid state sonochemistry, particularly by using a common ultrasonic cleaning bath.

References

1. Crawford, D. E. and Casaban, J.; Recent Developments in Mechanochemical Materials Synthesis by Extrusion. *Adv. Mater.* **2016**, *28*, 5747.
2. D. E. Crawford, A. Porcheddu, A. S. McCalmont, F. Delogu, S. L. James and E. Colacino, Solvent-free, Continuous Synthesis of Hydrazone-based Active Pharmaceutical Ingredients by Twin-Screw Extrusion, **2020**, *32*, 12230 (highlighted in C&EN, 30 September 2020, vol. 98, Issue 38).

VALERIO ISONI

Dr. Valerio Isoni leads the Process R&D team at the Institute of Chemical and Engineering Sciences (ICES, A*STAR), Singapore. Formally trained as a synthetic organic chemist, over the years he has been working with both chemists and chemical engineers at the interface between academia and industry on topics such as process development & scale up, sustainability, green chemistry, process intensification, continuous processing. In the Pharmaceutical Innovative Programme Singapore (PIPS) he co-leads the Plant Operations work stream.

DEVELOPMENT AND SCALE UP OF AN EXOTHERMIC REDUCTION IN A CONTINUOUS GRANULATOR

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Reductions are a class of generally exothermic reactions that are encountered in all stages of research and development as well as manufacturing of chemical entities. As the reactions make their ways from the laboratory to pilot plant or further downstream to manufacturing sites, several aspects need to be considered to safely manage heat evolution in yet a productive way. Among others, common mitigating factors to handle exothermic processes are dilution, fed-batch addition of the reducing species over long periods of time as well as conducting the reaction at low temperatures. While effective these approaches impact on productivity of such processes. In this talk the application of green chemistry principles such as waste reduction, hazard reduction, and the replacement of reagents and solvents to more benign alternatives will be presented for the case study of the liquid assisted grinding reduction of lipophilic aromatic aldehydes. Our journey from laboratory using a custom-made batch reactor to pilot plant scale for this reactive process run in a twin screw extruder will be described and comparison with an existing traditional solution based process will be presented.

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JOSÉ CASABAN

Jose Casaban is the Chief Technology Officer at MOF Technologies where he oversees the company's strategic technical initiatives. Jose is an expert in Metal-Organic Frameworks (MOFs) having worked on porous materials for the last 10 years. He has specialist knowledge in the revolutionary mechanochemical synthesis of MOFs (by milling and extrusion) and has led MOFTECH's environmentally friendly production of MOFs. He is responsible for key intellectual property and strategic partner R&D initiatives within MOF Technologies with several patents and publications to his name. Jose holds a BSc (Hons) in Chemistry from the University of Valencia/Imperial College of London and a PhD from Queen's University Belfast in gas phase catalysis/mechanochemistry.

MECHANOCHEMICAL SYNTHESIS OF METAL ORGANIC FRAMEWORKS: FROM LAB SCALE TO COMMERCIAL QUANTITIES

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Metal Organic Frameworks (MOFs) offer unparalleled gas adsorption properties due to their chemical tunability and unmatched porosity. MOF are consequently envisaged to play a key role in commercial gas storage and separation applications.

MOF Technologies has developed a new, continuous, environmentally friendly and cost-effective method for manufacturing MOFs using mechanochemistry.

MOF Technologies will present the upscale process from mg scale quantities synthesised in batch mode, to the continuous manufacture in our pilot plant facilities at 15 kg/h.

MOF Technologies will also introduce the continuous production of MOFs directly in shaped form and will benchmark the resulting production efficiencies (environmental and cost implications) against state-of-the-art processes.

https://www.moftechnologies.com/mof-production

MARIA ELENA RIVAS-VELAZCO

Degree in Chemistry with a PhD in synthesis of inorganic materials with 12+ years of experience on research and development, specifically in the areas of synthesis and characterisation. Principal Scientist in Johnson Matthey Technology Centre working on new materials development for different applications in the businesses. My research covers material synthesis and use of advance characterisation for improving understanding of metal mixed oxides. Before joining the industry, I spent four years as a post-doctoral researcher in different institutions in Europe.

UNDERSTANDING THE MECHANOCHEMICAL SYNTHESIS OF MIXED METAL OXIDE MATERIALS

Johnson Matthey, UK
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The use of mechanochemistry to prepare catalytic materials is of significant interest; it offers an environmentally beneficial, solvent-free, route and produces highly complex structures of mixed amorphous and crystalline phases. This study reports on the effect of milling atmosphere, either air or argon, on mechanochemically prepared $LaMnO_3$ and the catalytic performance towards N_2O decomposition (deN_2O). In this work, high energy resolution fluorescence detection (HERFD), X-ray absorption near edge structure (XANES), X-ray emission, and X-ray photoelectron spectroscopy (XPS) have been used to probe the electronic structural properties of the mechanochemically prepared materials. Moreover, in situ studies using near ambient pressure (NAP)-XPS, to follow the materials during catalysis, and high-pressure energy dispersive EXAFS studies, to mimic the preparation conditions, have also been performed.

References

1. Blackmore, R.H.; Rivas Velazco M.E. *et al. Dalton Trans.* **2020,** *49*, 232.
2. Blackmore, R.H.; Rivas Velazco M.E. *et al. Phys. Chem. Chem. Phys.* **2020,** *22*, 18774.

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DR. TANJA BENDELE (= DR. TANJA SMOLKA)

Dr. Tanja Bendele; LL.M. founded **RUHR-IP Patent Attorneys** in **2006**. She has more than 20 years of experience in all aspects of intellectual property rights, in counselling and representing with her law office global players international in all technologies.
Her main activities involve drafting and prosecution of patent applications, opposition as well as strategic counselling and preparation of expert opinions on Freedom to Operate (FTO-Opinions) in the following technological fields: Digital and Chemical Dental Area,

Her PhD thesis in **1999** Chemistry, Pharmaceutics, Medical Engineering, Material Sciences, Analytical Methods, Energy Storage Systems, Semiconductor Materials.concerned "Photochromic Supramolecular Co-Crystals" through crystallisation techniques, ball-milling and sublimation and establishment of different solid-state analytics for the characterisation of organic co-crystals, e.g. UV/Vis, NMR, ESR etc. and a new preparation method through ball-milling and sublimation.
Beginning her career in **2000** in the newly established **Patent department** of **ratiopharm GmbH, Ulm**, she was responsible for: Scientific advice on all polymorphism-relevant issues of ca. 200 active substances (INNs); Negotiation and drafting contracts; Establishment of solid-state analytical network for approval-relevant polymorphism tests in patent-free countries; Evaluation of the international patent situation of projects to avoid patent disputes; Assessment of international patent situation; Development of creative solutions to avoid infringement of critical patents;
2018: Member examination committee EQE at EPO Examination "European Patent Attorneys"
2019: Committee of German BAR Association "Patent Act and Utility model Act" / ca. 2013 former Member of German BAR Association "Patent evaluation"
2020: FOM – German-Sino School of Business and Technology; Expert "International Management – International Intellectual Property

PATENTS - POSSIBILITIES AND PROBLEMS – FOCUSING ON MECHANOCHEMISTRY FOR SUSTAINABLE INDUSTRY

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https://www.linkedin.com/in/tanja-dr-bendele-ll-m-a6830612/?locale=en_US)

First the key features of patenting inventions at the EPO are described following strategic examples for patenting of mechanochemistry innovations as well as requirements and possible problems are discussed. A short detour will be on the Unitary Patent System.

DR. HELMUT BUSCHMANN

Dr. Helmut Buschmann is a senior management executive with over 25 years of international experience in drug discovery research and drug development in the Pharmaceutical/Biotechnology sector. After his PhD in Organic Chemistry at the RWTH Aachen he started his career at Grünenthal GmbH Aachen, held several positions in pharmaceutical industry over the last years (Dr. Esteve, Barcelona; Savira pharmaceuticals, Vienna; AiCuris GmbH, Wuppertal) and worked as freelancer consultant in Life Science industry. Together with Dr. Norbert Handler he founded RD&C Research, Development & Consulting GmbH in Vienna in 2014, where he is managing several consulting projects and is involved in the development of novel pharmaceutical applications in mechanochemistry.

PHARMACEUTICAL APPLICATIONS IN MECHANOCHEMISTRY

RD&C Research, Development & Consulting GmbH, Austria
E-mail: office@rdc-concepts.com

Mechanochemistry is a versatile technique for several pharmaceutical applications. A broad variety of synthetic mechanochemical pathways is described in literature and will be presented in the talk. Additionally, the importance of mechanochemically induced co-crystal and salt formation as well as polymorph changes for the pharmaceutical R&D will be discussed.
Finally, own, innovative mechanochemical approaches for pharmaceutical stability and degradation studies and prediction will be presented and discussed in detail.

References

1. Tan, D.; Loots, L; Friscic, T. *Chem Comm* **2016**, *52*, 7760.
2. Kamali, N.; Gniado, K.; McArdle, P.; Erxleben, A. *Org. Process Res. Dev*. **2018**, *22*, 796.
3. Hasa, D.; Schneider Rauber, G.; Voinovich, D.; Jones, W. *Angew. Chem. Int. Ed.* **2015**, *54*,7371.
4. Trask, A.; Haynes, D.A.; Motherwell, S.; Jones, W. *Chem. Commun*. **2006**, *1*, 51.

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DR. NORBERT HANDLER

Dr. Norbert Handler is pharmacist by training and holds a PhD in Medicinal Chemistry. After several years as post-doc at universities and scientist in pharmaceutical industry, he founded together with Dr. Helmut Buschmann RD&C Research, Development & Consulting GmbH in Vienna in 2014, where he currently holds the position as Managing Partner. He is involved in several projects covering drug discovery and development, regulatory affairs and impurity profiling. Beside these activities, RD&C is specifically focusing on innovative approaches for profiling of pharmaceutical impurities and degradation products and is developing scientific concepts as well as fast and reliable predictive experimental methods especially for the solid state.

PHARMACEUTICAL APPLICATIONS IN MECHANOCHEMISTRY

RD&C Research, Development & Consulting GmbH, Austria
E-mail: office@rdc-concepts.com

Mechanochemistry is a versatile technique for many pharmaceutical applications. A broad variety of synthetic mechanochemical pathways is described in literature and will be presented in the talk. Additionally, the importance of mechanochemically induced co-crystal and salt formation as well as polymorph changes for the pharmaceutical R&D will be discussed.
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References
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