

6th International Symposium on Gas-Phase Synthesis of Functional Nanomaterials | September 9–11, 2024

Fundamental Understanding, Modeling and Simulation, Scale-up and Application

Venue: NETZ Building, Carl-Benz-Str. 199, 47057 Duisburg
<https://www.uni-due.de/cenide/netz/kontakt.php>

Keynote presentation: up to 30 min. + at least 10 min. for discussions

Oral presentation: up to 15 min. + at least 5 min. for discussions

Monday, September 9 th	
13:00–14:00	Arrival and Registration
14:00–14:10	Welcome <i>Christof Schulz, University of Duisburg-Essen</i>
Diagnostics and Data Analysis 1 (Chair: Khadijeh Mohri)	
14:10–14:50 Keynote	In situ optical measurements of aluminum combustion in steam <i>Zhongshan Li</i> (Lund University)
14:50–15:10	Light extinction and scattering to determine nanoparticle formation rates during droplet jetting in aluminum dust flames <i>Niklas Jüngst, Z. Wu, C. Ruan, M. Aldén, Z. Li</i> (Lund University)
15:10–15:30	Phase changes in burning precursor-laden single droplets leading to puffing and micro-explosion <i>Benjamin Südholt¹, A. Witte², G. J. Smallwood³, S. A. Kaiser¹, L. Mädler², N. Jüngst¹</i> (¹ University of Duisburg-Essen, ² University of Bremen, ³ National Research Council Canada)
15:30–15:50	In-situ measurements of the spectral absorption function for flame-made TiO₂ nanoparticles via light emission and Laser-induced incandescence: new results and open questions <i>Benedetta Franzelli, J. Yi, C. Betrancourt</i> (Paris-Saclay University)
15:50–16:10	Poster short presentations: Diagnostics All poster presenters

16:10–16:40 *Coffee break*

Fundamentals of Particle Formation, Reaction, and Growth 1 (Chair: Hartmut Wiggers)	
16:40–17:00	Black is the new orange: Inline synthesis of silica-coated iron oxide nanoparticles in a matrix burner <i>Claudia-Francisca López Cámara^{1,2}, S. Schleich², J. D. Estradioto^{2,3}, P. Fortugno², S. Salamon², J. Landers², H. Wiggers²</i> (¹ Eindhoven University of Technology, ² University of Duisburg-Essen, ³ Northwestern University)

17:00–17:20	Characterization of adsorbed polycyclic aromatic molecules on gas-phase synthesized carbon nanomaterials <u>Paolo Fortugno</u> ¹ , B. Apicella ² , C. Russo ² , H. Wiggers ¹ (¹ University of Duisburg-Essen, ² STEMS Napoli)
17:20–17:40	The influence of metal release mechanisms and micro-explosions on nanoparticle formation in single-droplet combustion <u>Jan Derk Groeneveld</u> , L. Mädler (University of Bremen)
17:40–18:00	Towards complete understanding of a prototypical iron oxide synthesis flame: the roadmap of the challenges ahead <u>Irenaeus Wlokas</u> ¹ , P. Cwiek ¹ , M. Nanjaiah ¹ , M. Lalanne ² , I. Rahinov ² (¹ University of Duisburg-Essen, ² Open University of Israel)
18:00–18:20	Poster short presentations: Fundamentals All poster presenters

Tuesday, September 10th

Fundamentals of Particle Formation, Reaction, and Growth 2

(Chair: Christof Schulz)

9:00–9:40 Keynote	Improved functional nanomaterials by online particle morphology characterization <u>Alfred Weber</u> (Clausthal University of Technology)
9:40–10:00	Influence of dispersion gas and resulting reaction zone on particle formation in spray flame synthesis <u>Orlando Massopo</u> ¹ , M. Bieber ² , S. Dupont ² , F. Fröde ² , H. Pitsch ² , M. Reddemann ² , R. Kneer ² , H.-J. Schmid ¹ (¹ Paderborn University, ² RWTH Aachen University)
10:00–10:20	The role of silanol in the formation of silica aggregates in TMS/H₂/O₂/Ar flames <u>Tina Kasper</u> , Y. Karakaya (Paderborn University)

10:20–10:50 *Coffee break*

10:50–11:10 Online	Gas-phase Si-hemiketal reactions: A novel molecular growth pathway in flame synthesis of SiO_x using siloxane precursor <u>Qilong Fang</u> ¹ , J. Fang ¹ , W. Li ¹ , H. Ma ² , H. Wang ² , Z. Wang ² , L. Zhao ² , Y. Li ¹ (¹ Shanghai Jiao Tong University, ² University of Science and Technology of China)
11:10–11:30	Shock-tube TOF-MS study of the decomposition of hexamethyldisiloxane <u>Rachel A. Schwind</u> ¹ , R. S. Tranter ² (¹ University of Edinburgh, ² Argonne National Laboratory)
11:30–12:00	Discussion: Fundamentals

12:00–14:00 *Conference Photo*
Poster Session & Lunch

14:00–14:40 Keynote	Gas-phase synthesis of carbonaceous nanomaterials <u>Stephen D. Tse</u> (Rutgers University)
Modeling and Simulation (Chair: Irenäus Wlokas)	
14:40–15:00	A semi-detailed kinetics model for the production of carbon nanotubes and H₂ from thermo-catalytic pyrolysis of methane <u>Matteo Pelucchi</u> ¹ , C. Giudici ¹ , A. Nobili ¹ , M. Bracconi ¹ , J. J. Vilatela ² , M. Maestri ¹ , (¹ Polytechnic University of Milan, ² IMDEA Materials Institute)
15:00–15:20	Investigation of effects of different chemical mechanisms on formation of graphene during gas-phase synthesis <u>Nick A. Eaves</u> , T. Tavangar (University of Windsor)
15:20–15:40	Iron nanoparticle formation in resolved single microparticle simulations <u>Bich-Diep Nguyen</u> , A. Scholtissek, T. Li, D. Ning, A. Dreizler, C. Hasse (Technical University of Darmstadt)

15:40–16:10 *Coffee break*

16:10–16:30 Online	Process design for gas-phase synthesis of iron nanoparticles from iron pentacarbonyl <u>Hossein Rhabar</u> , E. G. Gonzalez, M. R. Kholghy (Carleton University)
16:30–16:50	Modeling of metastable iron oxide nanoparticle formation in flame synthesis <u>Piotr Cwiek</u> ¹ , M.R. Lalanne ² , M. Nanjaiah ¹ , P. Wollny ¹ , Y. Karakaya ³ , T. Kasper ³ , S. Cheskis ⁴ , I. Wlokas ¹ , I. Rahinov ² (¹ University of Duisburg-Essen, ² The Open University of Israel, ³ Paderborn University, ⁴ Tel Aviv University)
16:50–17:10	Discussion: Modeling and Simulation
Diagnostics and Data Analysis 2 (Chair: Sebastian Kaiser)	
17:10–17:30	Optical in situ diagnostics of iron nanoparticle aerosols in microwave plasma <u>Hecong Liu</u> ¹ , G. Liu ² , T. Endres ¹ , C. Schulz ¹ (¹ University of Duisburg-Essen, ² Nanjing University of Science & Technology)
17:30–17:50	Transition from LII to PS-LIBS for various material systems <u>Jan Menser</u> , C. Schulz (University of Duisburg-Essen)

19:00–23:00 *Dinner* at Webster Brauhaus, Dellplatz 14, 47051 Duisburg

Wednesday, September 11th

Scale-up and Application

(Chair: Hartmut Wiggers)

9:00–9:20	Scalable manufacturing of nanostructured materials for energy and health applications using gas phase deposition <u>Ruud van Ommen</u> (Delft University of Technology)
9:20–9:40	Photo-polymerization using flame-made quantum dots for stable epoxy coatings <u>Keroles Riad</u> (Carleton University)
9:40–10:00	Carbon-TiO₂ based memristive film fabricated through flame synthesis technique for potential applications in non-volatile memory and neuromorphic systems <u>Abdul Khalique</u> ¹ , G. De Falco ² , M. Commodo ² , P. Minutolo ² , A. D'Anna ¹ (¹ University of Naples Federico II, ² STEMS Napoli)
10:00–10:20	A two-step strategy for synthesis of spherical non-aggregated multi-component particles by suspension-fed spray flame <u>Shuting Lei</u> ¹ , Y. Zhang ¹ , Z. Fang ¹ , T. Wu ¹ , X. Jin ² , S. Li ¹ (¹ Tsinghua University, ² Wuzhen Laboratory)

10:20–10:40 *Coffee break*

10:40–11:20 Keynote	The Iron Power Cycle: Single-particle level studies <u>Philip de Goey</u> (Eindhoven University of Technology)
11:20–11:40	Poster short presentations: Scale-up and Application All poster presenters
11:40–12:00	Discussion: Scale-up and Application

12:00–13:30 *Poster Session & Lunch*

Diagnostics and Data Analysis 3

(Chair: Sebastian Kaiser)

13:30–13:50	Spray-flame synthesis characterization using tomographic imaging with multi simultaneous measurements (TIMes): Volumetric emission, refractive index, and temperature fields <u>Cheau Tyan Foo</u> , F. J. W. A. Martins, A. Unterberger, S. Karaminejad, T. Endres, K. Mohri (University of Duisburg-Essen)
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13:50–14:10	On-line, real-time control concept for nanoparticle synthesis by electrical discharges <u>J. Weidemann</u> , D. Cuturic, S. Ding, E. Kruis (University of Duisburg-Essen)
14:10–14:30	Antagonistic impact of iron pentacarbonyl addition on the temperature and hydroxyl radical concentration in iron oxide synthesis flames <u>Igor Rahinov</u> ¹ M.R. Lalanne ¹ , M. Nanjaiah ² , P. Cwiek ² , S. Cheskis ³ , I. Wlokas ² (¹ The Open University of Israel, ² University of Duisburg-Essen, ³ Tel Aviv University)
14:30–15:00	Discussion: Diagnostics and Concluding Remarks
15:00	Optional Lab Tours

Posters:

Diagnostics and Data Analysis:

1. Evaluation of the spatiotemporal spray evolution from the SpraySyn II burner configuration in the FSP process
Malte F.B. Stodt, J. Kiefer, U. Fritsching (University of Bremen)
2. Visualization techniques for aerosol/aerosol mixing in a generic flow configuration
Laura Engelbracht-Kloß¹, G. P. Bewley², S. A. Kaiser¹ (¹University of Duisburg-Essen ²Cornell University)
3. Rapid determination of nanoparticle agglomerate morphology by mobility and aerodynamic measurements
Jonah Weidemann¹, G. A. Kelesidis², S. E. Pratsinis³, F. E. Kruis¹
(¹University of Duisburg-Essen, ²Delft University of Technology, ³ETH Zürich)
4. Combustion of single droplets in a confined 2-D microreactor
Arne Witte¹, S. D. Tse², L. Mädler¹ (¹University of Bremen, ²Rutgers University)
5. Optical Properties of Young Soot Formed in a Shock Tube: Simultaneous Reaction Time-resolved Laser-Induced Emission, UV-Vis Absorption, and Laser Extinction Measurements
Can Shao, J. Herzler, T. Dreier, T. Endres, M. Fikri, C. Schulz (University of Duisburg-Essen)
6. Flame structure of single aluminum droplets burning in hot steam-dominated flows
Zhiyong Wu, C. Ruan, N. Jüngst, E. Berrocal, M. Aldén, Z. Li (Lund University)

Fundamentals of Particle Formation, Reaction, and Growth:

1. Plasma treatment of electrode surfaces coated with nanoparticles
Moritz Sünner¹, T. Wagner¹, V. Vinayakumar¹, C. Marcks², A. Lorke¹, D. Segets¹, N. Wöhrl¹
(¹University of Duisburg-Essen, ²RWTH Aachen University)
2. Mass spectrometric investigation of the influence of water vapor and oxygen on gas-phase reactions of aluminium acetylacetonate using VUV-synchrotron radiation
Ilyas Adaköy¹, S. Grimm¹, P. Hemberger², A. Bodi², N. Tomasik¹, C. Horn¹, C. Rudolph¹, T. Bierkandt³, N. Gaiser³, B. Atakan¹ (¹University of Duisburg-Essen, ²Paul Scherrer Institute, ³Institute of Combustion Technology)

3. A monodisperse model for binary hetero-aggregate formation in mixing aerosol streams
Amir Karimi Noughabi, L. Engelbrach-Kloß, S. A. Kaiser, A. Kempf, I. Wlokas (University of Duisburg-Essen)
4. Flame Spray Synthesis of nanooxide for energy application
Silvana de Iulii¹, F. Migliorini¹, A. Pozio², F. Bozza², R. Donnini¹, R. Dondé¹
(¹CNR-ICMATE, ²ENEA, C.R. Casaccia)
5. Investigation of the Reaction Kinetics of Precursor Systems in Shock-Tube and Flow-Reactor Experiments
Jürgen Herzler, S. A. Mujaddadi, M. Fikri, C. Schulz (University of Duisburg-Essen)

Scale-up and Application:

1. Scalable fabrication of catalysts for proton exchange membrane water electrolysis
Peter M. Piechulla¹, M. Chen¹, M. Kräenbring², F. Özcan², D. Segets², J. R. van Ommen¹
(¹Delft University of Technology, ²University of Duisburg-Essen)
2. Improved stability and activity of Pt catalyst for sustainable hydrogen generation
Mingliang Chen¹, P. M. Piechulla¹, M.-C. Rekkers¹, M.-A. Kräenbring², F. Özcan², D. Segets², J. R. van Ommen¹ (¹Delft University of Technology, ²University of Duisburg-Essen)
3. Gas phase synthesis of SiNx nanoparticles for battery application using a hot-wall reactor
Atharva H. Ladole, M. Loewenich, M. Bilgili, H. Wiggers (University of Duisburg-Essen)
4. Synthesis and upscaling of silicon and a-SiCx nanoparticles for lithium-ion batteries in a hot-wall reactor
Moritz Loewenich¹, H. Orthner¹, P. Wollny¹, I. Wlokas¹, S. Bade², J. Lyubina^{2,3}, H. Wiggers¹
(¹University of Duisburg-Essen, ²Evonik Industries, ³Technical University of Darmstadt)
5. Pilot-scale spray-flame synthesis of iron oxide nanoparticles: Investigation of a hydrogen based burner concept
Martin Underberg¹, M. M. Prenting², T. Hülser¹, T. Endres², C. Schulz², H. Wiggers², S. M. Schnurre¹ (¹Institute of Energy and Environmental Technology, ²University of Duisburg-Essen)
6. Iron-based nanoparticles synthesized by Flame Spray Pyrolysis for strong magnetic properties
Edouard de Rolland Dalon, J. Hoarau, G. Jasmin-Lebras, P. Bonville, V. Mertens, E. Cournede, O. Taché, Y. Leconte (Paris-Saclay University)