

General information

Conference Contact

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Conference location

Thermotechnical Institute
Kasteelpark Arenberg 41
3001 Leuven, Belgium

Technical advice

- Technical information for conference participants (Online and physical)
- Practical information for physical participants
- Information for speakers

www.insect-symposium.de/insect-2021/author-information/

Please note:

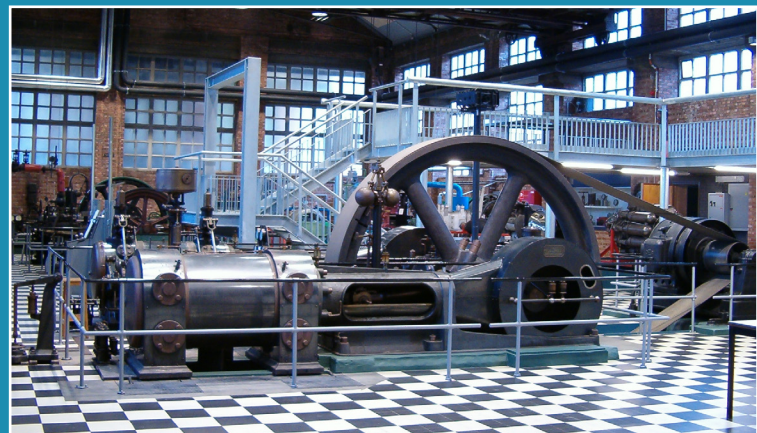
All times in the conference program are local times (CET, Brussels).

INSECT 2021

17th International Symposium
on Electrochemical Machining Technology

November 25-26, 2021 at KU Leuven, Belgium

www.insect-symposium.de



Program

Organizing committee:
Prof. Dr. ir. Dominiek Reynaerts
Dr. ir. Krishna Kumar Saxena
Ms. Anja Vansteenwegen



PROGRAM

Thursday, November 25, 2021

Please note: All times in the conference program are local times (CET, Brussels).

Dear colleagues,

It is an honor for KU Leuven to host the **17th International Symposium on Electrochemical Machining Technology (INSECT)** in Belgium during 25th and 26th November 2021. The INSECT is the only international platform dedicated to advances and developments for electrochemical machining technology and closely related processes.

With the advent of novel difficult-to-cut materials, increasing requirements on preserving product microstructure and properties, as well as the demand for high surface quality, Electrochemical Machining (ECM) is becoming an important process and when reviewing the state-of-the-art, one can only be surprised by the richness of research ideas and applications the field is counting.

To address future challenges, close cooperation between academic researchers and industrial partners is needed for further development of ECM technology and rapid transfer of knowledge from academia to industry and vice-versa. The INSECT 2021 forum brings together all parties and offers a perfect platform to exchange knowledge and contribute to new ideas in the field of electrochemical machining and related technologies.

The key topics of INSECT 2021 are Fundamentals, Materials, Processing and process monitoring, Simulation and Modeling, Process digital twins and applications of AI, Applications, Methods, and Hybrid EC processes. This resulted in 41 research papers with author affiliations from 13 countries: Germany, Netherlands, Belgium, USA, UK, China, Japan, India, Poland, Russia, France, Israel and Iran.

Due to the worldwide COVID situation, INSECT 2021 will be a hybrid event so we look forward to welcome you in Leuven or online!

Prof. Dominiek Reynaerts
Dept. Mechanical Engineering, KU Leuven

- 8:00 Registration, Coffee and croissants
- 8:30 Opening by Prof. Dominiek Reynaerts
- 8:45 Virtual tour of KU Leuven MaPS
- 8:55 Virtual tour of Flanders Make

Session 1: Fundamentals (9:10 – 10:30)

Chair: Dr. ing Michael Schneider,
Fraunhofer IKTS, Dresden, Germany

-
- 9:10 **Study of the multiphase electrolyte flow during electrochemical machining (ECM) using dynamic similarity**
E. Tchoupe ^a, L. Heidemanns ^a, T. Herrig ^a, A. Klink ^a
D. Lauwers ^b, W. Schröder ^b
^a RWTH Aachen University, Laboratory for Machine Tools and Production Engineering WZL, Germany
^b RWTH Aachen University, Chair of Fluid Mechanics and Institute of Aerodynamics, Germany
 - 9:30 **Investigation of plasma-electrolytic polishing (PeP) process initiation**
Henning Zeidler ^{a, b}, Sam Schröder ^a, Toni Böttger ^a, Michael Schneider ^c, Christoph Lämmel ^c, Frederic Sahr ^c, Joffrey Tardelli ^d, Loïc Exbrayat ^{d, e}
^a Technische Universität Bergakademie Freiberg, IMKF, Chair of Additive Manufacturing, Freiberg, Germany
^b Beckmann-Institute for Technology Development, Chemnitz, Germany
^c Fraunhofer IKTS, Dresden, Germany
^d IRT-M2P, 12 rue de l'Artisanat, 67120 Duppigheim, France
^e SafranTech, Rue des Jeunes Bois, 78772, Magny Les Hameaux, France

Session 1: Fundamentals (9:10 – 10:30)

- 9:50 **Electrochemical machining and plasma electrolytic polishing: differences and similarities**
W. Hoogsteen, S. Kadic and J. Buitendijk
Philips Consumer Lifestyle, Drachten, The Netherlands
- 10:10 **Analysis of the conditions for the formation of an electrolyte-plasma discharge between a metal anode and a ganged current lead**
A.I. Popov^a, A.I. Popova^a, A.S. Fumin^a, V.I. Novikov^b, M. V. Novoselov^a, S. V. Zakharov^a, V. G. Teplukhin^a, M. M. Radkevich^a
^a Peter the Great Saint Petersburg Polytechnic University, Saint Petersburg, 195251, Russia
^b Saint-Petersburg State University of Architecture and Civil Engineering, Saint Petersburg, 190005, Russia

10:30 **Coffee Break****Session 2: Processing/Process Control**

(10:45 - 12:25)

Chair: Prof. Dr. Masanori Kunieda,
University of Tokyo, Japan

- 10:45 **Conductive material filled electrodes for Micro Electrochemical Machining**
Guodong Liu, Yong Li, Hao Tong
Tsinghua University, Department of Mechanical Engineering, Beijing, China
Tsinghua University, State Key Laboratory of Tribology, Beijing, China

- 11:05 **Electrofinishing/Shaping of Refractory Materials (like Nb, Ta, and Mo) in HF-Free Low Viscosity Water Based Electrolytes**
T.D. Hall, R. Radhakrishnan, H. Garich, E.J. Taylor, M.E. Inman
Faraday Technology Inc., OH 45315, USA
- 11:25 **Research on characteristics of ECM with electrolyte confined by absorption material**
Tamon Obe, Wataru Natsu
Tokyo University of Agriculture and Technology, Japan
- 11:45 **Measurement using electrolyte jets**
Ivan Bisterov^a, Alistair Speidel^a, Sidahmed Abayzeed^b, Mohammed Zubyr^a, Adam Clare^a
^a University of Nottingham, Advanced Component Engineering Laboratory, Nottingham, United Kingdom
^b University of Nottingham, Optics and Photonics Research Group, Nottingham, United Kingdom
- 12:05 **Influence of Plasma-electrolytic Polishing on the functional properties of LBM Nitinol springs**
Vincent N. Stepputat^a, Daniel Safranchik^{a, b}, Henning Zeidler^{a, c}, Falko Böttger-Hiller^c
^a Technische Universität Bergakademie Freiberg, IKTS, Chair of Additive Manufacturing, Freiberg, Germany
^b Technion – Israel Institute of Technology, Technion City, Haifa 3200003, Israel
^c Beckmann-Institut für Technologieentwicklung e.V., Annaberger Strasse 73, 09111 Chemnitz, Germany

12:30 **Lunch**

Session 3: Materials (14:00 - 15:40)

Chair: Prof. Dr. Wataru Natsu,
Tokyo University of Agriculture and Technology,
Japan

14:00 Electrolyte impact on the passive layer formation of SSiC at high potentials

Lenka Šimůnková, Michael Schneider, Alexander Michaelis

TU Dresden, Institute for materials science, Helmholtzstr. 7, 01069 Dresden, Germany
Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), Winterbergstr. 28, 01277 Dresden, Germany

14:20 Jet-Electrochemical Surface Structuring of AlCoCrFeNiTi High-Entropy Alloy

André Martin^a, Franz Pfaffendorf^a, Hendrik Liborius^a, Thomas Uhlig^b, Thomas Lindner^c, Andreas Schubert^a, Guntram Wagner^b, Thomas Lampke^c

^a Chemnitz University of Technology, Professorship Micro manufacturing Technology, 09126 Chemnitz, Germany

^b Chemnitz University of Technology, Professorship of Composites and Material Compounds, 09125 Chemnitz, Germany

^c Chemnitz University of Technology, Materials and Surface Engineering Group, 09125 Chemnitz, Germany

14:40 Experimental study on ECM of Fe-25Al-1Zr and its influence on high temperature oxidation resistance

F. Sous^a, R. D. Pütz^b, A. Schupp^b, L. Heidemanns^a, T. Herrig^a, A. Klink^a, D. Zander^b, T. Bergs^a

^a RWTH Aachen University, Laboratory for Machine Tools and Production Engineering WZL, Campus-Boulevard 30, Aachen 52074, Germany

^b RWTH Aachen University, Chair of Corrosion and Corrosion Protection, Foundry Institute, 52072 Aachen, Germany

15:00 Experimental investigation of the electrochemical dissolution behavior of high purity nickel and its microstructural influence on the work result

M. Zeiner^a, T. Hall^a, D. Bähre^{a, b}

^a Saarland University, Institute of Production Engineering, Campus A4 2, 66123 Saarbrücken, Germany

^b Center for Mechatronics and Automation, Gewerbepark Eschberger Weg 46, Gebäude 9, 66121 Saarbrücken, Germany

15:20 Electrochemical micro-milling of niobium carbide (NbC) in different electrolytes and with laser assistance

Muhammad Hazak Arshad, Krishna Kumar Saxena, Jun Qian, Shuigen Huang, Dominiek Reynaerts

KU Leuven, Micro - & Precision Engineering Group, Division Manufacturing Processes and Systems (MaPS), Department of Mechanical Engineering, Belgium | Member Flanders Make

15:40 Coffee Break**Session 4: Applications (I)** (15:55 - 17:35)

Chair: Prof. Dr. ing Andreas Schubert,
Chemnitz, Germany

15:55 Investigation of through-mask ECM processes for applications in the PCB industry

Leonie Jakob, Carl Podevijn, Jonas Eckert, Sven Kluska, Jonas Bartsch

Fraunhofer Institute for Solar Energy Systems (ISE), Heidenhofstr. 2, 79110 Freiburg, Germany

Session 4: Applications (I) (15:55 - 17:35)**16:15 Microelectrochemical Machining of surgical needles: Experimental design and process parameters**Abhishek Lahiri ^a, Venelin Baldzhiev ^b, Atanas Ivanov ^b^a Brunel University, Department of Chemical Engineering, Uxbridge, UB8 3PH, United Kingdom (UK)^b Brunel University, Department of Mechanical, Aerospace and Civil Engineering (MACE), Uxbridge, UB8 3PH, United Kingdom (UK)**16:35 Electrochemical machining of implant components made from shape memory alloys**

Falko Böttcher, Karoline Kemter-Esser, Jan Edelmann

Fraunhofer Institute for Machine Tools and Forming Technology (IWU), Chemnitz, Germany

16:55 Jet-Electrochemical Machining of SSiCAndré Martin ^a, Franz Pfaffendorf ^a, Lenka Šimůnková ^b, Michael Schneider ^c, Andreas Schubert ^a,^a Chemnitz University of Technology, Germany^b TU Dresden, Institute for Material Science, Helmholtzstr. 7, 01069 Dresden, Germany^c Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), Winterbergstr.28, 01277 Dresden, Germany**17:15 Electrochemical machining of nickel-based single crystal superalloy: surface and microstructural analysis**

Ali Mehrvar

University of Isfahan, Department of Mechanical Engineering, Shahreza Campus, Iran

Session 5: Applications (II) (17:35 - 18:55)Chair: Prof. Dr. ing. Henning Zeidler,
TU Bergakademie Freiberg, Germany**17:35 Non-Linear Through-Hole Fabrication by Electrochemical Machining**

Andrew Moran, Victor Alderman, Brian Skinn, Stephen Snyder, Shane van Newkirk, Mike Horonzy, Timothy Hall, E Jennings Taylor

Faraday Technology, Inc., 315 Huls Dr., Englewood, OH 45315, USA

Republic Anode Fabricators, 5478 Grafton Rd., Valley City, OH 44280, USA)

17:55 Experimental Investigation on high-aspect-ratio blind hole drilled using ECM

Raghvendra Singh, Sanjay Agarwal

BIET Jhansi, Department of Mechanical Engineering, India.

18:15 Experimental study on removing support structures of additively manufactured metal parts using pulse electrochemical machiningThomas Hall ^{a,b}, Franziska Herter ^{a,b}, Dirk Bähre ^{a,b}^aSaarland University, Institute of Production Engineering, Campus A4 2, 66123 Saarbrücken, Germany^bCenter for Mechatronics and Automation, Gewerbepark Eschberger Weg 46, Gebäude 9, 66121 Saarbrücken, Germany**18:35 Electrochemical Surface Finishing Of Complex Additively Manufactured Parts**

T. D. Hall, H. Garich, D. Liu, S. T. Snyder, E.J. Taylor

Faraday Technology, Inc., 315 Huls Dr., Englewood, OH 45315, USA

18.55 Closure day 1**19:15 Conference dinner at the Faculty club**

08.30 Coffee and croissants

08.55 Opening day 2 by Prof. Dominiek Reynaerts

Session 6: Wire-ECM (09:00 - 10:20)

Chair: Dr. ing. Andreas Klink,
WZL, RWTH Aachen, Germany

9:00 **Influence of Electrolyte Flushing Methods on Characteristics of Wire ECM finishing of Wire EDMed Surfaces**

Sei Nakano ^a, Masanori Kunieda ^a, Tomoaki Takada ^b,
Toshiaki Kurokawa ^b, Takashi Yuzawa ^b

^a University of Tokyo, Department of Precision Engineering, Japan

^b Mitsubishi Electric, Hyogo, Japan

9:20 **Study of the wire ECM of cellular materials**

Dr. Hans-Peter Schulze ^a, Mathias Herzig ^a,
Oliver Kröning ^a and Andreas Popp ^b

^a Leukhardt Schaltanlagen und Systemtechnik GmbH NL
Magdeburg, Germany

^b TU Dresden, Germany

9:40 **Wire electrochemical trimming of titanium aluminum intermetallics**

Zhao Han, Xiaolong Fang, Di Zhu

Nanjing University of Aeronautics and Astronautics (NUAA), College of Mechanical and Electrical Engineering, Nanjing, 210016, China

10:00 **Development of a platform for wire based ECM finishing of 316L stainless steel**

Thomas Van Riel, Jun Qian, Bert Lauwers

KU Leuven, Division Manufacturing Processes and Systems (MaPS), Department of Mechanical Engineering, Belgium

10:20 Coffee break

Session 7: Simulation and data-driven models

(10:35 - 11:55)

Chair: Prof. Dr. ing habil. Matthias Hackert-Oschätzchen,
OVGU Magdeburg, Germany

10:35 **Simulation and experimental study on the anode shaping process during counter-rotating electrochemical machining**

Wenjian Cao, Dengyong Wang, Huayong Le

Nanjing University of Aeronautics and Astronautics (NUAA), Yudao Street 29, Nanjing 210016, China

10:55 **Data-driven framework of ECM: a machine learning model for profile prediction**

Ming Wu, Muhammad Hazak Arshad, Krishna Kumar Saxena, Jun Qian, Dominiek Reynaerts

KU Leuven, Micro -& Precision Engineering Group, Department of Mechanical Engineering, Belgium
Member Flanders Make

11:15 **Multiphysics Modeling of ECM for Low-Cost, Accelerated ECM Tool Design for Nickel and Titanium aerospace alloys**

Brian Skinn, Andrew J. Moran, Tim Hall

Faraday Technology Inc., OH 45315, USA

11:35 **Numerical analyses of plasma electrolytic polishing of 3D-printed metal part**

Manav Kothari, Utkarsh Anand, Divyansh Patel,
Radha Raman Mishra

Birla Institute of Technology and Science Pilani, Department of Mechanical Engineering,
Pilani-333031, India

12:00 Lunch

Company spotlight session (13:30 - 13:50)

Chair and Moderator: Dr. Willem Hoogsteen,
Philips Consumer Lifestyle,
The Netherlands

Title: Manufacturing of medical needles and cannulas by EDM/ECM hybrid process

Frank Schienle

CEO, PACE-Tec GmbH, Am Niegenhirschwald 3,
D-78120 Furtwangen, Germany

Session 8: New EC processes/configurations

(13:50 - 15:10)

Chair: Prof. Dr. ing. Dirk Bähre,
Saarland University, Saarbrücken, Germany

13:50 Electrochemical deposition of microstructures using liquid confinement

Xiaolei Chen, Jiajun Zhu, Jiasen Chen, Zhongning Guo

Guangdong University of Technology, Guangzhou
510006, PR China

Guangzhou Key Laboratory of Nontraditional Machining
and Equipment, Guangzhou 510006, PR China

14:10 Atomized electrolyte based electrochemical micromachining for sustainable manufacturing

Divyansh Singh Patel ^a, Yash Sharma ^a, Vyom Sharma ^b,
Vishal Agrawal ^c

^a Birla Institute of Technology and Science Pilani,
Department of Mechanical Engineering, Pilani- 333031,
Rajasthan, India.

^b Indian Institute of Technology Kanpur, Department of
Mechanical Engineering, Kanpur-208016, India.

^c RWTH Aachen University, Department of Mechanical
Engineering, Germany

14:30 Effect of electrolyte flow modes on the process performance during micro-electrochemical additive manufacturing (μ ECAM)

Muhammad Hazak Arshad, Rex Smith, Krishna Kumar
Saxena, Jun Qian, Dominiek Reynaerts

KU Leuven, Micro -& Precision Engineering Group,
Department of Mechanical Engineering, Belgium.
Member Flanders Make

14:50 Integrated Pulse/Pulse-Reverse Electrochemical Machining and Electrowinning for Metal Recovery, Elimination of Waste, and Minimization of Water Usage

B.T. Skinn, T.D. Hall, S.T. Snyder, E.J. Taylor

Faraday Technology Inc., 315 Huls Dr.,
Englewood, OH 45315, USA

15:10 Coffee Break**Session 9: Hybrid electrochemical processes**

(15:25 - 17:05)

Chair: Dr. ir. Krishna Saxena,
KU Leuven, Belgium

15:25 Experimental study on photocatalytic assisted electrochemical milling-grinding of SiCp/Al

Feng Wang ^{a,b}, Xiaoming Kang ^{a,b}, Wansheng Zhao ^{a,b}

^a Shanghai Jiao Tong University, School of Mechanical
Engineering, Shanghai 200240, China

^b State Key Laboratory of Mechanical System and
Vibration, Shanghai, China

Session 9: Hybrid electrochemical processes

(15:25 - 17:05)

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- | | | | |
|-------|--|-------|---|
| 15:45 | Simulation based design of magnetic-field assisted electrochemical machining
Ingo Schaarschmidt ^a , Raphael Paul ^a , Philipp Steinert ^a , Ophelia Frotscher ^b , Markus Richter ^b , Andreas Schubert ^a
a Chemnitz University of Technology, Professorship Micromanufacturing Technology, Faculty of Mechanical Engineering, Reichenhainer Str. 70, 09126 Chemnitz, Germany
b Chemnitz University of Technology, Professorship Applied Thermodynamics, Faculty of Mechanical Engineering, Reichenhainer Str. 70, 09126 Chemnitz, Germany | 16:45 | Announcement INSECT 2022 |
| 16:05 | Indicators of Hybrid ECM Process Supported by Magnetic Field and Ultrasonic Vibrations
Adam Ruszaj, Mariusz Cygnar,
Karolina Furyk - Grabowska, Marcin Grabowski
State University of Applied Sciences in Nowy Sącz, Engineering Institute, Poland
Cracow University of Technology, Institute of Production Engineering, Poland | 16:55 | Closing remarks INSECT 2021 by Prof. Dominiek Reynaerts |
| 16:25 | Experimental investigation of inner-jet electrochemical mill-grinding plane machining of 7050 aluminum matrix composite
Shukai Fan, Hansong Li, Binsen He, Xin Ma
Nanjing University of Aeronautics and Astronautics (NUAA), College of Mechanical and Electrical Engineering, Nanjing 210016, PR China | 17:10 | Coffee and goodbye |