Communication along the supply chain in the tooling industry
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HOST AND ORGANIZER

Conference Chairman
Prof. Dr.-Ing. Christoph Broeckmann
RWTH Aachen University
Chair and Institute for Materials Applications in Mechanical Engineering
Augustinerbach 4
52062 Aachen, Germany
www.iwm.rwth-aachen.de

Conference secretariat and organisation
TEMA Technologie Marketing AG
Svenja Hildebrandt
Aachener-und-Münchener-Allee 9
52074 Aachen, Germany
Phone: +49 (0)241 88970-303
info@tooling2019.com
www.tema.de

Content

11th www.tooling2019.com
Communication along
the supply chain in the
tooling industry

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HOST AND ORGANIZER
Dear Ladies and Gentlemen,

Tools play a crucial role in the manufacturing chain, as they substantially influence key factors not only in terms of cost and leadtime, but also for product design, quality and performance. Improvements in tooling, therefore, have the potential to strengthen the competitiveness of virtually any manufacturing company.

The 11th TOOLING conference & exhibition covers research and development within the complete scope of tooling, from material design and improvements to current market trends from all over the world. The main focus will be given to tool steels ranging from cold- and hot work tool steels to high speed steels and plastic mold materials.

TOOLING 2019 will take place in Aachen, a city fitting the conference slogan „communication along the supply chain in the tooling industry“ like no other. With internationally renowned research institutes located within RWTH Aachen University and its periphery, and based on an industrial background reaching from former steel mills to modern car production, supply chain management has been examined in Aachen for decades. In addition, its location in the triple meeting point of three European countries makes international communication essential for the entire region.

In order to facilitate communication, not only between scientists but also between science and industry there will be a number of ways to fill your time. Activities will include technical sessions, workshops, guided tours to local manufacturers and discussion sessions. This makes TOOLING 2019 one of the best chances you will have this year to extend your personal network and gain access to new trends and developments.

I am looking forward to see you either in one of the interesting talks, participating in discussion or simply roaming around Aachen.

Christoph Broeckmann,
Professor at the Institute for Materials Application in Mechanical Engineering (IWM) within RWTH Aachen University
EXCELLENCE IN SPECIALTY STEEL

Bars  |  Bright bars  |  Flat bars  
Semi-finished products  |  Wire  
Fine wire  |  Open-die forgings

BGH Edelstahlwerke GmbH
Am Stahlwerk 1
D-01705 Freital
www.bgh.de

Excellence in Specialty Steel
Conference Chairman:
Christoph Broeckmann, RWTH Aachen University, Germany

Scientific Committee (in alphabetical order):
Nader Asnafi, Örebro University, Sweden
Thomas Bergs, RWTH Aachen University, Germany
Jens Bergström, Karlstad University, Sweden
Kirsten Bobzin, RWTH Aachen University, Germany
Rafael Colás, University of Nuevo Leon, Mexico
Peter Dültgen, FGW Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Germany
Reinhold Ebner, Material Center Leoben, Austria
Christoph Escher, Dörrenberg Edelstahl GmbH, Germany
Frank Hippenstiel, BGH Edelstahlwerke GmbH, Germany
Bruno Hribernik, ASMET The Austrian Society for Metallurgy and Materials, Austria
Patrick Jacquot, Bodycote, France
Christoph Keul, FOSTA e.V., Germany
Harald Leitner, voestalpine BÖHLER Edelstahl GmbH & Co. KG, Austria
Anna Medvedeva, Uddeholms AB, Sweden
Marion Merklein, University Erlangen-Nürnberg, Germany
Rafael Agnelli Mesquita, CBMM, United States
Alberto Molinari, University of Trento, Italy
Massimo Pellizzari, University of Trento, Italy
Mario Rosso, University of Turin, Italy
Reinhold Schneider, Upper Austria University of Applied Sciences, Austria
Till Schneiders, Deutsche Edelstahlwerke GmbH, Germany
Sabine Siebert, Ruhr-Universität Bochum, Germany
Werner Theisen, Ruhr-Universität Bochum, Germany
Steve Udvardy, North American Die Casting Association, United States
Daniele Ugues, University of Turin, Italy
Hans-Joachim Wieland, FOSTA e.V., Germany
Hans-Werner Zoch, Leibniz Institute for Materials Engineering, Germany
YOUR EXPERTS FOR
- stainless, acid and heat-resistant steel
- tool steel
- engineering steel

Tradition meets innovation. With more than 160 years of experience, Deutsche Edelstahlwerke is one of the world's leading manufacturers of special steel long products. We offer international customers a uniquely wide range of product dimensions, from drawn wire with a diameter of 0.7 mm to open-die forgings with a diameter of 1,100 mm. We are specialized in tool steels, stainless, acid and heat-resistant steels, engineering steels as well as special materials.

Learn more: www.dew-stahl.com
### Program Structure

**12 May**
- 17:00  Pre-Registration
- 18:00-22:00  Get-together

**13 May**
- 9:00  Opening Session
- 11:00  Additive Manufacturing 1 – Hot Work Steel  |  Steel Design 1 – Cold Work Steel and HSS
- 14:00  Steel Design 2 – Hot Work Steel  |  Additive Manufacturing 2 – Cold Work Steel and HSS
- 16:15  Steel Design 3  |  Additive Manufacturing 3 – Hard Materials

**14 May**
- 8:30  Properties 1 – Hot Work Steel  |  Properties 4 – Cold Work Steel and HSS
- 10:45  Properties – Hot Work Steel  |  Properties 5
- 13:25  Properties 3 – Hot Work Steel  |  Additive Manufacturing 4
- 15:45  Manufacturing of Tool Steels  |  Tool Steel – Developments
- 18:00 – 23:00  Evening Event: Dinner at Ratskeller, Aachen

**15 May**
- 8:30  Simulation and Modelling 1  |  Processing 2 – Coating
- 10:40  Processing 1 – Machining  |  Testing
- 13:25  Processing 3 – Heat Treatment  |  Tools and Application 1
- 15:40  Tools and Application 2
- 17:00  Closing Session

**16 May**
- 9:00  Plant Visits:
  - **Tour RWTH Aachen University:** Institute for Material Application in Mechanical Engineering (IWM) and Fraunhofer Institute for Production Technology (IPT), Aachen
  - **Tour E-Mobility:** Visit of the e.Go production factory, Aachen
  - **Tour DEW:** Deutsche Edelstahlwerke plant, Krefeld

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Learn more: [www.dew-stahl.com](http://www.dew-stahl.com)
13 May

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<tr>
<td>9:00</td>
<td>Opening Session</td>
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<tr>
<td>9:15</td>
<td>Welcome in Aachen</td>
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<td>9:30</td>
<td>Key Note</td>
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<tr>
<td>10:00</td>
<td>Key Note</td>
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<tr>
<td>10:30</td>
<td>Coffee Break and Poster Presentation in the Exhibition</td>
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Welcome TOOLING 2019  
Christoph Broeckmann, RWTH Aachen University, Germany

Margrethe Schmeer, 1. Mayor City of Aachen, Germany

Steel – the key for a successful tooling industry!  
Frank Hippenstiel, BGH Edelstahl Siegen GmbH, Germany

Future requirements of automotive industries for accelerated tool construction and higher tool quality  
Hans Christian Wolff, Ford-Werke GmbH, Germany

Evening Event

In Aachen’s Town Hall, you feel the history of Germany and Europe. Distinguished guests have dined here since the 14th Century. We invite you for a nice evening in a historic atmosphere with music, short speeches, Hans Berns-Award presentation and a delicious buffet.

18:00 Shuttle from the venue to Ratskeller, Aachen

18:30 Start of the Evening Event at Ratskeller, Aachen  
Markt 40, 52062 Aachen

22:00 & 23:00 Shuttles back to venue and hotels
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<th>Time</th>
<th>Room 1 / Club Lounge 1</th>
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<tr>
<td></td>
<td>Additive Manufacturing 1 – Hot Work Steel Chair: Daniele Ugues, University of Turin, Italy</td>
<td>Steel Design 1 – Cold Work Steel and HSS Chair: Werner Theisen, Ruhr-Universität Bochum, Germany</td>
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<tr>
<td>11:00</td>
<td>Thermal fatigue and soldering resistance of additively manufactured hot work tool steels Mikael Åsberg, Pavel Krakhmalev, Karlstad University, Sweden; Christos Oikonomou, Henrik Andersson, Uddeholms AB, Sweden</td>
<td>Possibilities for niobium application in tool steels Rafael Mesquita, CBMM Consultant, United States</td>
</tr>
<tr>
<td>11:25</td>
<td>Corrosion resistant maraging steel for AM-produced plastic mold inserts Christoph Turk, Horst Zunker, Christin Aumayr, voestalpine Böhler Edelstahl GmbH &amp; Co KG, Austria</td>
<td>Effects of alloying elements in hardness modification during heat treatment of high-speed steels Ana Paola Braga, Mario Boccadini Jr., Felipe Carvalho, Roberto Andrade, Institute for Technological Research, Brazil</td>
</tr>
<tr>
<td>11:50</td>
<td>A complete solution in metal AM for tooling applications – a case study on plastic injection moulding Christos Oikonomou, Johnny Sjöström, Seshendra Karamchedu, Uddeholms AB, Sweden</td>
<td>A computational approach to the micro-structural design of high-speed steels Gero Egels, Werner Theisen, Ruhr-Universität Bochum, Germany; Sebastian Weber, University of Wuppertal, Germany; Nils Wulbieter, Ruhr-Universität Bochum, Germany</td>
</tr>
<tr>
<td>12:15</td>
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<td>Novel high-performance steels for the development of cast tools Nicola Schädelich, Uta Kühn, Kai-Uwe Baumgart, Josephine Zeisig, Julia Kristin Hufenbach, Leibniz Institute for Solid State and Materials Research, Germany</td>
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<td>12:40</td>
<td>Lunch in the Exhibition</td>
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| 14:00 | **Steel Design 2 – Hot Work Steel**  
Chair: Till Schneiders, Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG, Germany |
| 14:25 | **Characterization of a modified hot-working steel with increased wear resistance**  
Serdal Acar, Gregory Gerstein, Sebastian Herbst, Uwe Lorenz, Irfan Yousaf Malik, Kai Brunotte, Leibniz University Hannover, Germany |
| 14:50 | **New filler material for repair of high-performance steel tools by laser cladding**  
Josephine Zeisig, Leibniz Institute for Solid State and Materials Research, Germany; Alexander Fröhlich, Chemnitz University of Technology, Germany; Julia Hufenbach, Nicola Schädlich, Leibniz Institute for Solid State and Materials Research, Germany; Verena Kräusel, Chemnitz University of Technology, Germany; Uta Kühn, Leibniz Institute for Solid State and Materials Research, Germany |
| 15:15 | **Development of an intelligent hot-working steel to increase the tool wear resistance**  
Uwe Lorenz, Leibniz University Hannover, Germany; Bernd-Arno Behrens, Serdal Acar, Gregory Gerstein, Florian Nürnberg, Jan Puppa, Institute of Forming Technology and Machines, Germany |
| 15:40 | Coffee Break and Poster Presentation in the Exhibition |

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<tr>
<th>Time</th>
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| 14:00 | A new precipitation hardening steel to improve the lifetime of close die forging tools  
Johannes Fuchs, Frank Hippenstiel, BGH Edelstahl Siegen GmbH, Germany |
| 14:25 | Processing of X65MoCrW3-2 cold work tool steel by selective laser melting  
Johannes Boes, Arne Röttger, Werner Theisen, Ruhr-Universität Bochum, Germany |
| 14:50 | Processing of high carbon steels by selective electron beam melting (SEBM)  
Marie Jurisch, Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Germany; Thomas Wenz, Barradas Schweißtechnik GmbH, Germany; Silvia Vock, Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Germany; Bernd Kieback, Technische Universität Dresden, Germany; Burghardt Klöden, Alexander Kirchner, Thomas Weißgärber, Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Germany |
| 15:15 | Mechanical properties of high speed steel AISI M50 produced by laser powder bed fusion  
Johannes Kunz, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Christoph Broeckmann, RWTH Aachen University, Germany; Johannes Henrich Schleifenbaum, Jasmin Saeve, Fraunhofer Institute of Laser Technology, Aachen, Germany; Anke Kalesch, Simone Herzog, RWTH Aachen University, Germany |
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<td><strong>Steel Design 3</strong>&lt;br&gt;Chair: Farhad Rezai-Aria, Ecole des Mines d’Albi, France</td>
<td><strong>Additive Manufacturing 3 – Hard Materials</strong>&lt;br&gt;Chair: Sabine Siebert, Ruhr-University Bochum, Germany</td>
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<tr>
<td>16:15</td>
<td>A new steel for plastic moulds combining corrosion resistance, high hardness, high ductility and very good polishability <strong>Magnus Tidesten</strong>, Anna Medvedeva, Magnus Brännbacka, Henrik Nöbauer, Seshendra Karamchedu, Uddeholms AB, Sweden</td>
<td>Material and process development for additive manufacturing of cemented carbide tool shafts <strong>Tim Schubert</strong>, Gerhard Schneider, Timo Bernthaler, Aalen University, Germany; Dirk Sellmer, MAPAL Dr. Kress KG, Germany; Markus Merkel, Harald Riegel, Thomas Rieger, Aalen University, Germany</td>
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<td>16:40</td>
<td>Influence of microsegregations on local phase stabilities in martensitic stainless cast steel <strong>Frederic van gen Hassend</strong>, Sebastian Weber, University of Wuppertal, Germany</td>
<td>Laser based additive manufacturing of WC-Co with high temperature powder bed pre-heating <strong>Sofia Fries</strong>, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Markus Benjamin Wilms, Fraunhofer Institute for Laser Technology, Germany; Martin Seimann, RWTH Aachen University, Germany; Andreas Weisheit, Fraunhofer Institute for Laser Technology, Germany; Anke Kaletsch, Thomas Bergs, Christoph Broeckmann, RWTH Aachen University, Germany</td>
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<td>17:05</td>
<td>Effect of V on the phase amounts and the composition of MC carbides in indefinite chill alloys <strong>Armin Paar</strong>, Eisenwerk Sulzau-Werfen R. &amp; E. Weinberger AG, Austria; Reinhold Schneider, FH-OÖ F&amp;E GmbH, Austria; Christof Sommitsch, Graz University of Technology, Austria; Michael Aigner, Thomas Trickl, Eisenwerk Sulzau-Werfen, R. &amp; E. Weinberger AG, Austria</td>
<td>Additive manufacturing of hardmetal based tools <strong>Christian Berger</strong>, Johannes Pötschke, Tassilo Moritz, Fraunhofer Institute for Ceramic Technologies and Systems, Germany</td>
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<tr>
<td>17:30</td>
<td>Optimization of TiC hard particles morphology in metal matrix composites by niobium addition <strong>Andreas Mohr</strong>, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany; Werner Theisen, Arne Röttger, Ruhr-Universität Bochum, Germany; Horst Hill, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany</td>
<td>Additive manufacturing of metal matrix composites <strong>Philipp Kluge</strong>, Andreas Mohr, Horst Hill, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany; Marie Jurisch, Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Germany</td>
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### 14 May

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| Properties 1 – Hot Work Steel  
Chair: Frank Hippenstiel, BGH Edelstahlwerke GmbH, Germany | Properties 4 – Cold Work Steel and HSS  
Chair: Harald Leitner, voestalpine BÖHLER Edelstahl GmbH & Co. KG, Austria  

#### 8:30
- **Alloy modification of classical CrMoV tool steels for special applications**  
  **Frank Hippenstiel**, Johannes Fuchs, BGH Edelstahl Siegen GmbH, Germany

#### 8:55
- **The most important material properties to resist thermal fatigue in hot work tool steel used in high pressure die casting**  
  **Anders Thuvander**, Anna Medvedeva, Uddeholms AB, Sweden

#### 9:20
- **The influence of the lath morphology on the fracture toughness of AISI H11 tool steel austempered below MS**  
  **Jian Feng**, Marc Wettlaufer, Heilbronn University, Germany

#### 9:45
- **Heat checking patterns and their relation with oxidation on a tool steel containing second-phase particles**  
  **Ana Paola Braga**, Institute for Technological Research, Brazil; Luiz Lima, Roberto Souza, University of Sao Paulo, Brazil; Mario Boccalini Jr., Institute for Technological Research, Brazil

#### 10:10
- **Coffee Break and Poster Presentation in the Exhibition**
### Properties 2 – Hot Work Steel
Chair: Jens Bergström, Karlstad University, Sweden

- Properties and service life of the hot work tool steel Thermodur E 40 K Superclean for die casting applications
  - Markus Gürcan, Philipp Niederhofer, Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG, Germany
- Examples for failures and failure prevention in tooling
  - Till Schneiders, Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG, Germany

### Properties 5
Chair: Reinhold Schneider, Upper Austria University of Applied Sciences, Austria

- Influence of hot hardness and microstructure of high-alloyed PM tool steels on abrasive wear behaviour at elevated temperatures
  - Nils Wulbieter, Werner Theisen, Kevin Czoske, Simon Walbaum, Ruhr-Universität Bochum, Germany
- Laser-based tensioning of circular saw blades
  - Peter Dültgen, Ralph Keßler, Forschungs-gemeinschaft Werkzeuge und Werkstoffe e.V., Germany; Rabi Lahdo, Christian Hennigs, Sarah Nothdurft, Michael Hustedt, Stefan Kaierle, Laser Zentrum Hannover e.V., Germany

### 10:45
**10:45**
- Quench embrittlement in hot work tool steels
  - Rafael Mesquita, CBMM Consultant, United States; Reinhold Schneider, Upper Austria University of Applied Science, Austria; Renato Logiudice, João Henrique Storopoli, University Nove de Julho, Brazil
- Influnce of hot hardness and microstructure of high-alloyed PM tool steels on abrasive wear behaviour at elevated temperatures
  - Nils Wulbieter, Werner Theisen, Kevin Czoske, Simon Walbaum, Ruhr-Universität Bochum, Germany

### 11:10
- Manufacturing of container and stem forgings for the extrusion industry - materials and properties
  - Günter Zeiler, Volker Wieser, voestalpine BÖHLER Edelstahl GmbH & Co KG, Austria
- Laser-based tensioning of circular saw blades
  - Peter Dültgen, Ralph Keßler, Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Germany; Rabi Lahdo, Christian Hennigs, Sarah Nothdurft, Michael Hustedt, Stefan Kaierle, Laser Zentrum Hannover e.V., Germany

### 11:35
- Influence of dissipation on abrasive wear of a powder metallurgical mold steel in plastics injection molding
  - Walter Friesenbichler, David Zidar, Montanuniversität Leoben, Austria; Timo Gebauer, SIGMA Engineering GmbH, Germany; Andreas Blutmager, Wittmann Battenfeld Group, Austria

### 12:00
- Properties of tool steels for application in hot stamping
  - Philipp Niederhofer, Kathrin Eger, Deutsche Edelstahlwerke Specialty Steel GmbH & Co KG, Germany; Patrik Schwingenschlögl, Marion Merklein, Friedrich-Alexander-University Erlangen-Nürnberg, Germany
- Influence of dissipation on abrasive wear of a powder metallurgical mold steel in plastics injection molding
  - Walter Friesenbichler, David Zidar, Montanuniversität Leoben, Austria; Timo Gebauer, SIGMA Engineering GmbH, Germany; Andreas Blutmager, Wittmann Battenfeld Group, Austria

### 12:25
- Lunch in the Exhibition

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**Time** | Room 1 / Club Lounge 1 | Room 2 / Sky Lounge 1
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**10:45** | Properties and service life of the hot work tool steel Thermodur E 40 K Superclean for die casting applications | Examples for failures and failure prevention in tooling
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<td>13:30</td>
<td>Thermo-mechanical fatigue testing of dual hardening tool steels <em>Matthias Hofinger</em>, Ronald Schnitzer, Montanuniversität Leoben, Austria; Kapp Marianne, Harald Leitner, Christoph Turk, Miloslav Ognjanov, voestalpine BÖHLER Edelstahl GmbH &amp; Co KG</td>
<td>Combined AM-processes (r)evoluting the tooling world <em>Jürgen Küppershaus</em>, Alexander Taube, voestalpine Edelstahl Deutschland GmbH, Germany</td>
</tr>
<tr>
<td>13:55</td>
<td>Investigation of thermal fatigue resistance of different hot work tool steels in aluminum wheel molds <em>Bora Yav</em>, CMS Wheels &amp; Makina San. Inc., Turkey</td>
<td>Methodology for integration of additive manufacturing in tool manufacturing process chains <em>Moritz Wollbrink</em>, Kristian Arntz, Fraunhofer Institute for Production Technology, Germany; Thomas Bergs, Fraunhofer Institute for Production Technology, Germany</td>
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<tr>
<td>14:20</td>
<td>Life time enhancement of forging dies with tailored diffusion treatments <em>Hanno Paschke</em>, Martin Weber, Markus Mejauscheck, Fraunhofer Institute for Surface Engineering and Thin Films, Germany; Dominik Lenz, Institute for Tool Research and Materials, Germany; Kai Brunotte, Martin Siegmund, Lenny Lippold, Institute of Forming Technology and Machines, Germany</td>
<td>Feasibility study of manufacturing several tool steels by selective laser melting <em>Svenja Richert</em>, Hans-Günter Krull, Horst Hill, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany; Jasmin Saewe, Rui Joao Santos Batista, Sebastian Bremen, Fraunhofer Institute for Laser Technology, Germany</td>
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<tr>
<td>14:45</td>
<td>Fracture toughness of a hot work tool steel fabricated by selective laser melting <em>Massimo Pellizzari</em>, Sebastiano Furlani, University of Trento, Italy; Faraz Deirmina, Sandvik AB, Sweden; Bandar Almangour, Saudi Arabia Basic Industries Corporation, Saudi Arabia; Dariusz Gresziak, West Pomeranian University of Technology, Poland</td>
<td>High-alloyed steel powders with increased nitrogen content for laser additive manufacturing <em>Alwin Schulz</em>, Leibniz Institute for Materials Engineering, Germany; Frank Wälther, Jochen Tenkamp, Felix Stern, Technische Universität Dortmund, Germany; Johannes Boes, Werner Theisen, Arne Röttger, Karina Geenen, Ruhr-Universität Bochum, Germany; Volker Uhlenwinkel, Hans-Werner Zoch, Leibniz Institute for Materials Engineering, Germany</td>
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<td>15:10</td>
<td>Coffee Break and Poster Presentation in the Exhibition</td>
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<td>Manufacturing of Tool Steels</td>
<td>Tool Steel – Developments</td>
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<td>Chair: Sebastian Weber, Bergische Universität Wuppertal, Germany</td>
<td>Chair: Mario Rosso, University of Turin, Italy</td>
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<tr>
<td>15:45</td>
<td>Microstructure and properties of spray formed large section M35 high speed steel <strong>Hongqing Wu, Ling Qiu, Mingda Zheng, Shanghai University, China</strong></td>
<td>Characterization of damaging mechanisms and evolution of surface stress state on a hot work tool steel subjected to cyclic immersion in molten aluminum alloy <strong>Federico Simone Gobber, Mario Rosso, Daniele Ugoes, Politecnico di Torino, Italy</strong></td>
</tr>
<tr>
<td>16:10</td>
<td>Manufacturing of as-cast ingots made for tool steel applications <strong>Tobias Dubberstein, Alexander Kovalev, Michael Richter, Schmiedewerke Gröditz GmbH, Germany</strong></td>
<td>Profile cross rolling of high interstitial austenitic stainless steels for application in plastics extrusion <strong>Erik Forke, Fraunhofer Institute for Machine Tools and Forming Technology, Germany; Philipp Niederhofer, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany; Mirko Albrecht, André Hüllmann, Verena Kräusel, Technische Universität Chemnitz, Germany; Till Schneider, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany; Michael Gehde, Technische Universität Chemnitz, Germany</strong></td>
</tr>
<tr>
<td>16:35</td>
<td>Challenges and solution approaches for the processing of a cold work tool steel by means of selective laser melting <strong>Christian Mutke, Christoph Escher, Dörsrenberg Edelstahl GmbH, Germany</strong></td>
<td>A modification of ostergren model for thermomechanical fatigue life prediction of die-casting die steel <strong>Pengpeng Zuo, Xiaochun Wu, Chang Yong, Mingda Zheng, Shanghai University, China</strong></td>
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<td>18:00</td>
<td>Shuttle to Conference Dinner, Ratskeller Aachen</td>
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**Hans Berns-Award**

At this year’s TOOLING 2019, the “Hans Berns-Award”, which commemorates Prof. Hans Berns, is to be conferred for the first time. Prof. Hans Berns was one of the founding fathers of the Tooling Conference that emerged in the 1980s from national Swedish symposia on tooling. The first International Tooling Conference was initiated by Dr. Hans Nordberg (Uddeholm), Prof. Hans Berns (Ruhr University Bochum), and Prof. George Krauss (Colorado School of Mines) and took place in 1987 in the USA.
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<td><strong>Simulation and Modelling</strong></td>
<td><strong>Processing 2 – Coating</strong></td>
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<td>Chair: Nader Asnafi, Örebro University, Sweden</td>
<td>Chair: Kirsten Bobzin, RWTH Aachen University, Germany</td>
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<td>8:30</td>
<td>Ingot casting simulation of high speed steel 1.3343 <strong>Felix Neukam</strong>, Hans-Günter Krull, Adam Gießmann, Deutsche Edelstahlwerke Specialty Steel GmbH &amp; Co. KG, Germany</td>
<td>STAMPDUR PLUS® – a modern tool steel concept for high requirement hot stamping applications <strong>Duan Wang</strong>, Buderus Edelstahl GmbH; Mitja Schimek, voestalpine eifeler Lasertechnik GmbH, Germany; Eugenie Klöpfer, Peter Vetter, Buderus Edelstahl GmbH, Germany</td>
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<td>8:55 Hot isostatic pressing with integrated heat treatment: FE-Simulation of cold work tool steel D7 <strong>Carola Birke</strong>, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Yuanbin Deng, RWTH Aachen University, Germany; Ali Rajaei, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Anke Kaletsch, Christoph Broeckmann, RWTH Aachen University, Germany</td>
<td>Innovative coating processes for high performance mold and die application <strong>Pierre Collignon</strong>, Rene Scheibe, PD2i Europe GmbH, Germany</td>
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<td>9:20</td>
<td>Numerical simulation of tempering of thermal cycling of a die-casting mold – AISI H13 <strong>Valerian Iss</strong>, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Bengt Hallstedt, Christoph Broeckmann, RWTH Aachen University, Germany</td>
<td>Self-lubricating PVD coatings for dry cold massive forming <strong>Dennis Christopher Hoffmann</strong>, Kirsten Bobzin, Tobias Brägelmann, Nathan Christopher Kruppe, Fritz Klocke, Thomas Bergs, Daniel Trauth, Robby Mannens, Rafael Hild, RWTH Aachen University, Germany</td>
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<td>9:45</td>
<td>Effect of cooling behavior on the microstructure evolution of C-ring specimen during deep cryogenic treatment <strong>Xijuan He</strong>, Junwan Li, Xijuan He, Shanghai University, China</td>
<td>Metal ion etching behavior of high-speed steels <strong>Juliane Kampichler</strong>, Materials Center Leoben Forschung GmbH, Austria; Harald Leitner, voestalpine BÖHLER Edelstahl GmbH &amp; Co KG, Austria; Stefan Marsoner, Gerald Ressel, Thomas Klünsner, Materials Center Leoben Forschung GmbH, Austria</td>
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<td>10:10</td>
<td>Coffee Break and Poster Presentation in the Exhibition</td>
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<td><strong>Processing 1 – Machining</strong></td>
<td><strong>Testing</strong></td>
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<td>Chair: Thomas Bergs, RWTH Aachen University, Germany</td>
<td>Chair: Reinhold Ebner, Material Center Leoben, Austria</td>
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<td>10:45</td>
<td><strong>Effects of different electrical discharge machining strategies on the high cycle fatigue of plastic injection mold steel</strong> Marcel Olivier, Thomas Bergs, Tim Herrig, Andreas Klink, Fritz Klocke, RWTH Aachen University, Germany</td>
<td><strong>Design of a roll test bench for investigating thermo-mechanical tool wear</strong> Josef Domitner, Thomas Stern, Alexander Leitner, Graz University of Technology, Austria; Michael Aigner, Armin Paar, Thomas Trickl, Leonel Elizondo, Eisenwerk Sulzau-Werfen, R. &amp; E. Weinberger AG, Austria; Christof Sommitsch, Graz University of Technology, Austria</td>
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<td>11:10</td>
<td><strong>Optimization of the temperature field for laser hardening of cold-work tool steel</strong> Kristian Arntz, Fraunhofer Institute for Production Technology, Germany</td>
<td><strong>The method for evaluation of heat checking in die casting</strong> Huilin Deng, Masakatsu Tatsutani, Masamichi Kawano, Daido Steel Co., Ltd., Japan</td>
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<td>11:35</td>
<td><strong>Simulation of residual stresses after grinding of martensitic cold work tool steel</strong> Ali Rajaei, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany; Thomas Bergs, Daniel Trauth, Sebastian Barth, Christoph Broeckmann, RWTH Aachen University, Germany; Bengt Hallstedt, Institute of Applied Powder Metallurgy and Ceramics at RWTH Aachen e.V., Germany</td>
<td><strong>Development of a test rig for simulation of surface damaging of hot work tool steels for die casting dies</strong> Federico Simone Gobber, Andrea Pisa, Argo s.r.l., Italy; Mario Rosso, Daniele Ugues, Politecnico di Torino, Italy</td>
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<td>12:00</td>
<td><strong>Micromachining of hardened high speed steel</strong> Alexander Meijer, Technische Universität Dortmund, Germany</td>
<td><strong>Quantitative determination of retained austenite by X-ray diffraction: an overview of measurement uncertainty</strong> Christoph Turk, Marek Kuchta, voestalpine BÖHLER Edelstahl GmbH &amp; Co KG, Austria; Karin Brandner, University of Leoben, Austria; Thomas Höngiann, Technical University Graz, Austria; Carlos Martinez, voestalpine BÖHLER Edelstahl GmbH &amp; Co KG, Austria</td>
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<td>12:25</td>
<td>Lunch in the Exhibition</td>
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<td>13:30</td>
<td>Processing 3 – Heat Treatment Chair: Alwin Schulz, Leibniz Institute for Materials Engineering, Germany</td>
<td>Tools and Application 1 Chair: Rafael Agnelli Mesquita, University of Trento, Italy</td>
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</table>
| 13:30  | Effect of the cooling conditions and Ni-additions on the phase transformation and secondary hardening behavior of an HSS-type alloy  
*Reinhold Schneider*, University of Applied Sciences Upper Austria; Michael Aigner, Armin Paar, Leonel Elizondo, Thomas Trickl, Eisenwerk Sulzau-Werfen R. & E. Weinberger AG, Austria; Simona Kresser, University of Applied Sciences Upper Austria | 3D metal printing of stamping tools & dies and injection molds  
*Nader Asnafi*, Örebro University, Sweden; Anton Alveflo, voestalpine High Performance Metals Sweden AB, Sweden |
| 13:55  | Microstructures, heat treatment and properties of boron alloyed tool steels  
*Jonathan Lentz*, Ruhr-Universität Bochum, Germany | Efficient lay-out and process specific optimization of complex 3D tempering systems in pressure die cast and polymer injection molds  
*Goetz Hartmann*, MAGMA Gießereitechnologie GmbH, Germany |
| 14:20  | Deep cryogenic treatment of X153CrMoV12 cold-work tool steel  
*Serdal Acar*, Gregory Gerstein, Florian Nürnberg, Leibniz University Hannover, Germany; Chensong Cui, Alwin Schulz, Matthias Steinbacher, Leibniz Institute for Materials Engineering, Germany; Martin Wunde, Jochen Kurzynski, VDEh Betriebsforschungsinstitut GmbH, Germany | Variothermal mold heating by infrared radiation – an interaction between material and technology  
*Werner Berlin*, Michael Demes, Jan Beuscher, Klaus Dröder, Technische Universität Braunschweig, Germany |
| 14:45  | Carbonitriding of forging dies to improve lifetime  
*Heinrich Klümper-Westkamp*, Hans-Werner Zoch, Marian Georg Skalecki, Stefanie Hoja, Leibniz Institute for Materials Engineering, Germany | Development of composite tool steels via successive spray forming and selective heat treatment  
*Chensong Cui*, Dawid Nadolski, Alwin Schulz, Leibniz Institute for Materials Engineering, Germany |
<p>| 15:10  | Coffee Break and Poster Presentation in the Exhibition | |</p>
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<td><strong>Tools and Application 2</strong>&lt;br&gt;Chair: Christoph Keul, FOSTA e.V., Germany</td>
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<td>15:45</td>
<td>The development of market requirements for plastic mold steels on the example of the automotive industry&lt;br&gt;&lt;i&gt;Alexander Hengst&lt;/i&gt;, Schmiedewerke Gröditz&lt;br&gt;GMH Gruppe, Germany</td>
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<td>16:10</td>
<td>Design of a flashless forging die for a single pin crankshaft forging&lt;br&gt;&lt;i&gt;Prashant Date&lt;/i&gt;, Indian Institute of Technology Bombay, India; Sameer Bagalkotkar, Prashant Patil, Sansera Engineering Company, India; A. R. Kumbhar, Satyajeet Kulkarni, Automotive Research Association of India</td>
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<td>16:35</td>
<td>Experimental abrasive contact analysis – dynamic forces between grinding discs and steel for common angle grinder applications&lt;br&gt;&lt;i&gt;Alexander Dürkopp&lt;/i&gt;, Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Germany; Matthias Dörr, Sebastian Zimprich, Tim Bruchmüller, Karlsruher Institute of Technology, Germany; Alexander Dürkopp, Hans-Jürgen Gittel, Christian Pelshenke, Peter Dültgen, Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Germany</td>
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<td>17:00</td>
<td>Closing Session&lt;br&gt;Chair: Christoph Broeckmann, RWTH Aachen University, Germany</td>
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### Poster Presentation

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<tr>
<th>Title</th>
<th>Authors</th>
<th>Institution</th>
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<tr>
<td>Effect of mechanical strain on microstructure of a novel hot work tool steel 4Cr5Mo2NiV</td>
<td>Yan Zeng, Pengpeng Zuo, Zhenqiang Zhu, Shanghai University, China</td>
<td>China</td>
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<td>Failure analysis of a crankshaft forging die</td>
<td>Weidong Dang, Pengpeng Zuo, Zhixiong Bai, Weidong Wang, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Effect of Ni and Co on continuous cooling transformation behavior and performance of 4Cr5Mo2V hot work die steel</td>
<td>Boya Wu, Jie Ji, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Study on microstructure evolution in large cross-section plastic die steel during multidirectional forging</td>
<td>Junwan Li, Xiaoxiao Zhang, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Failure analysis of a crankshaft forging die</td>
<td>Weidong Dang, Pengpeng Zuo, Zhixiong Bai, Weidong Wang, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Effect of tempering process on microstructure and properties of 2CrNiMoMnV plastic die steel</td>
<td>Xuan Chen, Yubin Wang, Le Zhang, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Hybrid wire- and powder-based laser metal deposition for modification of local properties of H11 dies</td>
<td>Mahesh Teli, Fraunhofer Institute for Production Technology, Germany; Fritz Klocke, RWTH Aachen University, Germany; Kristian Arntz, Kai Winands, Fraunhofer Institute for Production Technology, Germany, Thomas Bergs, RWTH Aachen University, Germany</td>
<td>Germany</td>
</tr>
<tr>
<td>Effect of carbon content on the continuous cooling transformation characteristics of Cr-Mo-V die steel</td>
<td>Xijuan He, Le Zhang, Hongaing Wu, Ling Qiu, Shanghai University, China</td>
<td>China</td>
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<tr>
<td>Effect of magnetic field on carbide morphology and property of electroslag remelted Cr12MoV ingots</td>
<td>Qiang Li, Yunbo Zhong, Cuxiong Sun, Tianxiang Zheng, Weili Ren, Zhongming Ren, Shanghai University, China</td>
<td>China</td>
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<td>Effect of heat treatment procedure on the corrosion resistance of 4Cr13 steel</td>
<td>Weidong Dang, Le Zhang, Yubin Wang, Chuanjiang Lv, Shanghai University, China</td>
<td>China</td>
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<td>Design of extrusion die geometry for making sheets from a mixture of metal powder and polymer</td>
<td>Prashant Date, Indian Institute of Technology Bombay, India; Serge Alexandrov, Ishlinskii Institute for Problems in Mechanics, Russia; Devanand Doifode, Indian Institute of Technology Bombay, India</td>
<td>India</td>
</tr>
<tr>
<td>Influence of loading on oxidative wear behavior of SDH55 hot work die steel</td>
<td>Xiaochun Wu, Yufeng Sun, Qiang Sun, Zhixiong Bai, Shanghai University, China</td>
<td>China</td>
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We create global high-end marketing for technology to enable our client’s sustainable growth

Since 2003, TEMA is engaged in steel industry and provides innovative marketing ideas, e.g. for:

- ThyssenKrupp and Deutsche Edelstahlwerke (3D animation visualizing the complete process of hot rolling)
- SMS (3D animation)
- Steelinstitut VDEh (Event Management: SCT Steels in Cars and Trucks, ESTAD European Steel and Application days)
- FOSTA Stahlforschung (Event Management, Graphic)

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Plant Visits 16 May

Please note that the maximum number of participants per tour is limited. Participation will be handled on a first-come-main-first-served basis. The buses will depart near the entrance of the conference venue. All plant visits take place on the same day. Therefore, it is not possible to participate in more than one tour. The plant visits are subject to change. We are sorry for not being able to guarantee an exact time schedule, which depends on the duration of the plant visits and traffic situation. If the minimum number of participants is not reached we will regretfully have to cancel that visit.

Tour RWTH University Institute for Material Application un Mechanical Engineering (IWM) and Fraunhofer Institute for Production Technology (IPT) in Aachen

Scientific research at the IWM deals with a wide field of application of metals, ceramics and composites materials. It includes modern powder based production routes of materials and parts, heat treatment of metallic components and design of materials and components concerning complex mechanical loads. Both, experimental testing and numerical simulation are used as solution approach.

The Fraunhofer IPT develops systems solutions for production. We focus on the topics of process technology, production machines, production quality and metrology as well as technology management.

Estimated timetable:
Departure at the venue: 9:00
Arrival at the venue: 12:00
Tour E-Mobility
Visit of the e.Go production factory, Aachen

e.GO Mobile AG was founded in 2015 by Prof. Dr. Günther Schuh as a manufacturer of electric vehicles. On the RWTH Aachen campus, the 300 employees so far not only benefit from the pioneering project StreetScooter, they also use the unique network of the campus with its research facilities and approx. 360 technology companies. Agile teams are working on various cost-effective and customer-oriented electric vehicles for short-distance traffic. For series production, e.GO Mobile AG is currently putting its new Industrie 4.0 plant in Aachen into operation.

Estimated timetable:
Departure at the venue: 9:00
Arrival at the venue: 15:00

Tour DEW
Deutsche Edelstahlwerke plant in Krefeld

Deutsche Edelstahlwerke is one of the world’s leading manufacturers of special steel long products. Deutsche Edelstahlwerke can look back on over 160 years of experience in the production of high-grade steel products. The range of products is unique worldwide and includes tool steels, stainless, acid and heat-resistant steels, engineering and bearing steels, and special materials. The product portfolio ranges from 0.7 mm drawn wire to forged products of up to 1,100 mm in diameter. Deutsche Edelstahlwerke customers receive the entire manufacturing chain from a single source: from production to prefabrication to heat and surface treatment. Deutsche Edelstahlwerke is a company of the SCHMOLZ + BICKENBACH Group.

Estimated timetable:
Departure at the venue: 9:00
Arrival at the venue: 15:45
VENUE:

Tivoli, Aachen
Krefelder Straße 205
52070 Aachen, Germany

TEMA
The Host:

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RWTH Aachen University
Chair and Institute for Materials Applications in Mechanical Engineering
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52062 Aachen

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