



Twelfth International
Aluminum Extrusion Technology Seminar & Exposition

A Clear Vision for the Future

May 19–21, 2020

Hyatt Regency Orlando • Florida USA

Join us for the most anticipated technical event
in the aluminum extrusion industry!

ET20.org



Featuring:

**120+ Technical Sessions • ET Expo
nETworking • ET Showcase
In-Conjunction Workshops and more**



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Twelfth International
Aluminum Extrusion Technology
Seminar & Exposition

ET'20: A Clear Vision for the Future

May 19–21, 2020

Hyatt Regency Orlando
International Drive • Florida, USA

ET20.org



Help Us Celebrate 50 Years of ET

ET 2020 marks a big milestone – the 50th Anniversary of the International Aluminum Extrusion Technology Seminars! Join us in Orlando, Florida for a memorable and exciting week including:

- **Technical Sessions**
- **ET Expo & ET Showcase**
- **nETworking Events**
- **Add-on Workshops**
- **Special Events & more!**

What's So Special About ET?

ET is so special that it only occurs once every four years. The event, focused solely on the aluminum extrusion industry, is unequalled. **Experience** the latest research and technology advances in the aluminum extrusion field at the 120+ **technical sessions** presented by global experts in every aspect of extrusion – technical, scientific and research.

The education aspect of ET is unparalleled – it's the only place with this level of diversity in terms of extrusion information and technical knowledge.

Explore the dynamic **ET Expo**, featuring products, equipment and services from the world's foremost industry suppliers. More than a trade show, ET Expo is the hub of knowledge, where challenges are met with new ideas and solutions.

Engage in **nETworking** opportunities to develop, expand and enhance your connections, business success and career growth. ET '20 is the ideal place to share ideas and experiences, mentor new talent, meet tough challenges and plan for future success.

ET is learning, best practice, and preparing extrusion companies for the future.

Expand your knowledge and skills with **add-on workshops** before and/or after ET '20. The one-day educational events cover aluminum extrusion processes and technologies to help optimize and improve operations, providing a comprehensive learning experience when coupled with your ET '20 registration. See page 14 for details.

The Team Advantage

ET offers a wealth of information to everyone on your team. From technical sessions to in-conjunction workshops, to ET Expo, Showcase and nETworking, ET provides the forum for all things aluminum extrusion that your team members will value and utilize.

ET is a great way to invest in your people and bring new people forward

Your ET investment will reap ongoing benefits for your established senior staff and for the up-and-coming generation of new industry talent. Save on registration fees with **ET Team Discounts!** See the Registration Form for details.



The ET Foundation reserves the right to alter the program or substitute speakers as needed.

Join Us in Orlando!

Connect in Orlando

Orlando's top-rated meeting destination is the perfect backdrop for connecting with colleagues, exchanging ideas and seeking knowledge to meet tomorrow's challenges. And of course, Orlando is the place for fun and excitement! From exceptional local arts, theater and music, to world-class theme parks, cuisine and entertainment, Orlando has something for everyone.



Getting To and Around Orlando

Orlando is located in Central Florida, with convenient global access via Orlando International Airport. The Hyatt Regency Orlando Hotel is 13 miles from the Orlando International Airport. Several options are available for getting to/from the hotel and airport, as well as taking in the nearby entertainments, restaurants, theme parks and more. All are easily accessible by car, shuttle, taxi or limo service, trolleys and buses – it's easy to get around in Orlando! Many are within walking distance from the Hyatt.



Work Hard, Play Hard

After a very busy and enlightening week, discover the best that Orlando offers. Come for ET '20, then stay and play! Special Convention-Goer links to discounted attraction tickets will be available starting this summer to all ET '20 delegates at **ET20.org**. Plan ahead – don't miss this opportunity to take part in ET's 50th Anniversary, and then celebrate with some well-earned time in the Florida sunshine over the Memorial Day Holiday weekend!

Travel and Lodging



Hyatt Regency Orlando

9801 International Drive
Orlando, Florida 32819 USA

Hotel Reservations by phone: 1.800.501.1990

Online: ET20.org

Reservations, cancellations and changes to accommodations must be made directly with the Hyatt Regency Orlando via the link found on ET20.org or the phone number provided above.

A block of rooms at the special rate of **\$249/night (single or double, plus tax and resort fee)** for ET '20 delegates is being held at the Hyatt Regency Orlando until **April 20, 2020**. After that date, group rates can no longer be guaranteed and rooms will be subject to availability, so be sure to make your room reservations as soon as possible.

If calling to make reservations, be sure to mention ET '20 – Twelfth International Aluminum Extrusion Technology Seminar to obtain the special rates.

International Guests

Generally, all international travelers require a visa to enter the United States. The ET Foundation recommends that you apply for your visa at least three months in advance of your scheduled trip to avoid processing delays.

Letter of Invitation

If required for travel to the U.S., a Letter of Invitation can be supplied only after you have registered for ET '20 and payment has been received in full. Details regarding obtaining an invitation letter can be found on the ET '20 website.

To make your trip go as smoothly as possible, please take some time to review the information provided on the ET '20 website regarding travel to the United States.

For complete details and updates on Orlando travel, lodging and attractions, visit the ET website at **ET20.org**.

ET '20 Expo: Where People, Products and Services Converge

The ET Expo, held in conjunction with the ET Seminar, is the on-site marketplace and information headquarters where providers of aluminum extrusion industry products and services connect directly with decision-makers. More than just a trade show, it's the place to meet with top industry suppliers to learn about the latest innovations and offerings to enhance your business. Knowledgeable exhibitors can answer your questions, share ideas and offer solutions.



ET Expo Hours*

Tuesday, May 19 12:30 p.m. – 6:30 p.m.

Wednesday, May 20 10:00 a.m. – 7:00 p.m.

Thursday, May 21 10:00 a.m. – 3:30 p.m.

* Hours subject to change.

For a complete listing of exhibitors, and an interactive floor plan featuring exhibitor product and service details and links to company websites, visit **ET20.org**

ET Showcase

Near the ET Expo, **ET Showcase** highlights ET Foundation Professional and Student Design Competition winning entries, and reveals aluminum extrusion applications that inspire and amaze.

From automotive to industrial, cutting edge and exciting applications will be highlighted to demonstrate the advantages of aluminum extrusion.

ET Expo Exhibitors

At press time, the companies listed (below) are scheduled to exhibit at ET '20 EXPO.

Abtex Corporation
Albarrie Canada Limited
Almax Mori Srl
Almex USA, Inc.
Alvarez Schaer S.L.
AMCOL Corporation
American Plating Power
AZON USA, Inc.
BASF/Chemetall US, Inc.
BCI Surface Technologies
Belco Industries Inc.
Butech Bliss
Castool Tooling Systems
Combilift Ltd.
Compes International

Die Cleaning Equipment and Supply, Inc.
Eastern Oil Company
ECOFILL BV/
ECOFILL USA, LLC
Emmebi
EXCO
Extex Ltd.
Foy Inc.
Graf Technik GmbH
Granco Clark, Inc.
Inductotherm Heating & Welding – Banyard
ISRA Parsytec GmbH
Italtecno Srl
Kautec Solutions
Kintner, Inc.

Lake Park Tool & Machine, LLC
MARX GmbH & Co. KG
Nitrex Metal Inc.
Novatec Process Systems Inc.
Nutec Bickley
OMAV S.P.A.
Otto Junker GmbH
Perfection Servo
Phoenix-Youngstown Tool & Die
Presezzi Extrusion Group
QForm Extrusion/
Forge Technology, Inc.
Quaker Houghton

SAT (Surface Aluminium Technologies) Srl
Schmolz + Bickenbach USA
SMS group
STAS Inc.
Tellkamp Systems, Inc.
Thumb Tool & Engineering
Trasmetal SpA
Tuff Temp Corp.
Turla Srl
UBE Machinery Inc.
Uddeholm USA
Wagstaff, Inc.
WEFA Cedar Inc.
Weite Extrusion Press

ET'20 Program Ahead

General Session Highlights

Keynote Speaker



NASA Astronaut, Mike Massimino

Michael Massimino, or Astro Mike, is a Professor of Mechanical Engineering at Columbia University, New York, and a former NASA Astronaut whose tenure includes two Space Shuttle missions to the Hubble Telescope, and four space walks (EVAs) to make critical telescope repairs. Mike is senior space advisor to the Intrepid Sea, Air & Space Museum in New York City. He is a frequent news, talk and late-night television guest, a *New York Times* best-selling author and was a recurring guest on the U.S. Television Show *The Big Bang Theory*. He offers his unique perspective on teamwork, innovation and leadership.

photo courtesy:
Jeffrey Schiffman

Best Paper Awards

The best of the best are highlighted at ET! Awards for the best papers of the Twelfth International Aluminum Extrusion Technology Seminar will be presented during the General Sessions.

ET Foundation Design Competition Awards

Winners of the 2020 Aluminum Extrusion Design Competition, including students and professionals, will be presented. Watch for the 2020 Design Competition Call for Entries coming this fall at ETFdesign.org!



*This is an early preview of the General Session program. Visit **ET20.org** for updates as they become available.*

Special Events

ET '20 will include a variety of special events designed to foster nETworking connections. Choose from the following events; additional registration and fees apply as noted. Visit ET20.org for complete details.

ET 50th Anniversary Celebration "Spirit of Aloha" Dinner Show

Thursday, May 21

7:00 p.m. – 10:45 p.m.

Cost: \$95.00 per person

Join this Golden ET Anniversary Celebration Event – the Spirit of Aloha Dinner Show at Disney's Polynesian Village Resort, Luau Cove. Register early to guarantee your seat at this fantastic event of tropical-inspired food and exciting South Seas entertainment. Dinner and show is scheduled from 8:15 p.m. to 10:15 p.m.

Includes bus transport to/from the event; All-you-care-to-enjoy Luau feast, beer, wine, soft drinks, lemonade, or coffee (cocktails on your own). (Taxes, service fees and tip included. This is a non-smoking outdoor/covered facility.)

ET Founders Golf Tournament

Friday, May 22

7:00 a.m. – 4:30 p.m.

Cost: \$155.00 per person

**Optional equipment rental:
\$48.00 per person;**

Join us for the 50th Anniversary ET Founders Golf Event at Disney's Palm Golf Course. The tournament on this PGA-rated course features a shotgun start. Optional equipment rental, including golf clubs, balls and shoes, is available for an additional \$48 per person (includes tax). Registration is very limited – reserve your spot early!

Your round includes round-trip bus transport to/from the tournament, greens and cart fees, pre-round practice range balls, bag handling & locker room; plus prizes and box lunch at the Tournament's end. Bus departs from the Hyatt for the golf course at 7:00 a.m., and bus shuttles return to Hyatt starting at 1:30 p.m., with last bus departing course at 4:30 p.m.

Kennedy Space Center Tour

Friday, May 22

7:00 a.m. – 4:30 p.m.

Cost: \$95.00 per person;

Join us for an out-of-this-world ET special excursion to the Kennedy Space Center (KSC) and Visitor's Center Complex. Includes round-trip Motor Coach to/from the Hyatt; 45-minute KSC Staff-Guided Tour, approximately two hours to visit KSC Museum, including Apollo, Space Shuttle, Saturn V Rocket exhibits and IMAX movies; and Noon Lunch with an Astronaut.

Bus departs the Hyatt at 8:00 a.m. arriving by approximately 9:15 a.m. Return bus departs KSC Visitor Complex at 1:45 p.m., returning to the Hyatt by approximately 3:00 p.m.

The ET Foundation reserves the right to alter the program or substitute speakers as needed.

ET'20: Technical Sessions

The following abstract titles represent technical papers under consideration for presentation at ET '20. The complete abstracts and updates to the program may be viewed on the ET20.org website. Abstracts online are organized according to the tracking code that appears above each title.

BP: Billet Process & Equipment Track

BP4

Fully Integrated Remelt Facilities for Billet Production—The Most Advanced Casthouses Worldwide

Andrew Beevis, Hertwich Engineering GmbH, Austria

BP16

DFF: The Drain-Free CFF Technology

Ulf H. Tundal, Hydro Aluminium, and Terje Haugen, Hycast AS, Norway

BP18

Extrusion Billets Cast with Varying Grain Refiner Additions for Use in High-Gloss Products

Takeshi Saito, Magorzata C. Halseid, Ulf H. Tundal, and Oddvin Reiso, Hydro Aluminium; and Eva A. Mørtzell, Hydro R&D; and Tore Kolås, SINTEF Industry, Norway

BP21

A Billet Growth Story

Dushyant Kumar Gupta, Ram Sandipam Adhikary, Vedanta Limited, India

BP31

Modeling the Precipitation of Dispersoids during Homogenization of 3xxx-Series and 6xxx-Series Extrusion Billets

Warren Poole and Chenglu Liu, The University of British Columbia; and Lei Ray Pan and Nick C. Parson, Rio Tinto Aluminium, Canada; and Qiang Du, SINTEF Materials and Chemistry, Norway

BP57

History and Development of Aluminum Dross Processing

David Roth, GPS Global Solutions, USA

BP66

Effect of Change in Amounts of Main Alloying Elements on Structural Properties of Direct Chill Casted 6xxx-Series High-Strength Aluminum Alloy Osman H. Celik, Mert Altay, Mehmet B. Guner, and Gorkem Ozelik, ASAS Aluminum, Turkey

BP67

How to Adjust the Size and Distribution of Dispersoids in AA6082 for a Perfect Microstructure

Andreas Schiffl, Hammerer Aluminium Industries Extrusion GmbH; and Aurel Arnoldt, Leichtmetallkompetenzzentrum Ranshofen, Austria

BP69

Influence of Heat Treatment on Interfacial Bonding in Co-Extrusion of Compound-Cast AA7075/AA6060 Bi-Layer Billets

Hui Chen and Noomane Ben Khalifa, Leuphana University of Lüneburg; Danai Giannopoulou, Helmholtz-Zentrum Geesthacht; and Thomas Gress, Tim Mittler, and Wolfram Volk, Technical University of Munich, Germany

BP70

Producing Quality Billets in a Safe and Sustained Environment

Hussain Mohd Amin Faqihi, Aluminium Bahrain BSC (Alba), Bahrain

BP103

Technology Roadmap: Manufacturing Extrudable Secondary Aluminum Products with Attributes Comparable to Primary Aluminum Feedstock

Subodh Das, Phinix, LLC, USA

BP113

Can Our Industry Prevent Molten Metal Explosions?

Alex W. Lowery, Wise Chem LLC, USA

BP119

Quality of Billet and Its Influence on the Extrusion Process

Arif Husain, Mushtaq Mohammed, and Mansoor Mohammed, Gulf Extrusions, LLC, UAE

BP127

5xxx-Series Extrusions for Automotive Applications with Outstanding Intergranular Corrosion Resistance

Hubert Koch and Luisa Marzoli, TRIMET Aluminium SE; Felix Gensch, INGWERK GmbH; and Soeren Mueller, Extrusion R&D Center, TU-Berlin, Germany

BP130

Automated Billet Surface Inspection

Dominic Vezina, Pascal Cote, and Jean-Pierre Gagne, Stas, Canada

BP131

OptimAire Balance Billet Tooling Technology

Kedar Tilak and Sathi Sivapalan, Almix USA Inc., USA

BP159

The Implementation of a Comprehensive Dross Management Program

James Herbert, ALTEK, USA

BP160

Case Study of Air-Cooled Electromagnetic Stirred Melting Furnace

James Herbert, ALTEK, USA

BP161

The Industrial Application of Molten Metal Analysis (LIBS)

James Herbert, ALTEK, USA

BP164

Billet Casting Technology for Increased Production and Diversified Alloys

Gary Grealy, Wagstaff, Inc., USA

BP174

The Maturing of Low-Pressure Casting (LPC) Technology

Arild Hakonsen and Rune Ledal, Hycast AS, Norway

BP176

Performance Evaluation of High Flow Ceramic Foam Filters on Aluminum 6061 Alloys

Bob Eivani, Drache USA; Jason Evoy, Metalco, Inc., USA; and Jochen Schnelle, Drache Umwelttechnik GmbH, Germany

BP178

High-Quality Forging Material

Arild Hakonsen and Rune Ledal, Hycast AS; and Ulf H. Tundal, Knut O. Tveito, Lars A. Moen and Magne Boge, Hydro, Norway



EE: Extrusion Equipment Track

EE23

Extrusion Spray Quench with Distortion Control System

David Jenista and Drew Griffioen, Granco Clark, Inc., USA

EE33

Functional Guarding of Horizontal Extrusion Presses

Bradley C. Wyatt and Mark C. Eliopoulos, Kaiser Aluminum, USA

EE34

Billet Magnet Heater: ZPE

Andrea Persegoni, Presezzi Extrusion SpA, Italy

EE41

Applying Non-Destructive Examination Methods to Extrusion Presses

Ronald Manganello, Richard Manganello and Alyssa Porter, Carlesa NDE Services, USA

EE44

Automatic Surface Inspection during Aluminum Extrusion

Dominik Recker, ISRA Parsytec GmbH, Germany

EE47

Log Heating System Controls – Better Data Collection for a Better Process

Davide Turla and Alessandro Guerrini, Turla SrL., Italy

EE48

Process Control Hardware and Software on Modern Extrusion Presses

Alessandro Guerrini and Davide Turla, Turla SrL., Italy

EE62

Next Generation 4.0 of Energy-Saving System and Hydraulic Solutions for Aluminum Extrusion Presses

Dario Bracesco, Danieli BRED, USA; and Mauro Baldassi, Danieli BRED, Italy

EE63

New Concept for Handling Systems of Aluminum Extrusion Presses

Dario Bracesco, Danieli BRED, USA; and Mauro Baldassi, Danieli BRED, Italy

EE64

A Step Ahead in Human Machine Interface and Remote Support for Aluminum Extrusion Plants

Dario Bracesco, Danieli BRED, USA; and Mauro Baldassi, Danieli BRED, Italy

EE73

Frequency Control for Induction Heating of Billets Prior to Extrusion

Jacob G. Friend, Inductotherm Heating & Welding Ltd., UK

EE76

Cost Preventive Extrusion

Arvind Singh, Jindal Aluminium Limited, India

EE80

Innovative Fast Die Cleaning of Extrusion Dies with Safe and Automatic Operation

Marcello Rossi, Fabio Vincenzi and Federico Vincenzi, Italteco SrL, Italy

EE91

Save over 1.4 Million Dollars in Utility Costs Utilizing Electric Induction Billet Heating

Thomas Kearney, Induction Professionals, USA

EE106

Modernization of a 6k-Ton Extrusion Press Hydraulic System

Steve Demar, Hauhinco, USA

EE107

Can We Eliminate Manual Lubrication in Aluminum Extrusion?

James E. Dyla, AMCOL Corporation, USA

EE110

Innovative Approach for Extrusion Billet Loading: Robots

Zachary Yost, SMS group, USA

EE123

A New Approach to Safeguarding a Modern Extrusion Plant

Tyson Bunker, Hydro Aluminum; and Carsten Dede, OMAV, USA

EE126

Billet-End Scrap Detection

Troy M. Rice, Tubelite Inc., USA

EE143

Advantages of High-Convection Heaters for Combined Billet Heating

Jan van Treek, OTTO JUNKER, Germany

EE145

Advantages of Induction Billet Heaters versus Magnetic Billet Heating

Jan van Treek, OTTO JUNKER, Germany

EE147

Achieving True Press Alignment with Precision Laser Tracker Measuring

James Cunningham, Cunningham Mechanical Design, USA

EE154

Modernizing the Extrusion Press and Handling System: Rebuild & Retrofit or Replace?

David Turnipseed, Aluminum Extrusion Marketplace, LLC; and Al Kennedy, Kennedy Eurotech, Inc., USA

EE158

The Triple-Layer Counterplaten: Zero Die Trials Every Time

Mike Wegener, UACJ-Whitehall; Carsten Dede, OMAV, USA; and Hans-Uwe Rode, SMS group, Germany

EE179

Your Equipment At a Glance

Giovanni Scristani, OMA S.P.A., Italy



EP: Extrusion/Die – Practical Track

EP6

Accurate Pyrometer for Control and Logging Aluminum Profile Cooling Rate
Boris Shtarker and Ofer D. Yoely, Accurate Sensors Technologies, Israel

EP7

Extrusion Productivity - Billet Geometry/Container/Dummy Block
Paul H. Robbins and Yahya Mahmoodkhani, Castool Tooling Systems; and Chris Jowett, Rio Tinto Aluminium, Canada

EP9

Recovery Improvement - A Continuous Process
Dosi Uttam Chand and Devaraj Padavu, Jindal Aluminium Limited, India

EP10

Importance of Temperature in Extrusion Technology
Dosi Uttam Chand and Devendra Kumar Sain, Jindal Aluminium Limited, India

EP11

Innovative, Environmentally-Friendly Release Agents for the Dummy Block
Martin Hartlieb, Motultech Baraldi, Canada; and Cosimo Raone and Piero Parona, Motultech Baraldi, Italy

EP12

State-of-the-Art in Aluminum Extrusion Die Design and Manufacturing; the Way to Zero Die Corrections
Tommaso Pinter, Almax Mori SrL., Italy

EP13

Quality Requirements of Aluminum Extrusions for Aerospace Applications
Pradip K. Saha, The Boeing Company, USA

EP14

High-Performance Multi-Micro-Port Extruded Tubes
Rolf Beckert, WEFA Inotec GmbH, Germany; and Pawel Kazanowski, Hydro Precision Tubing Rockledge; and Joachim Maier, WEFA Cedar Inc., USA

EP24

Measuring Instantaneous Extrusion Quench Performance
Drew T. Griffioen, Granco Clark, Inc., USA

EP25

Effect of Press Quench Rate on Automotive Extrusion Performance
Nick C. Parson, Rio Tinto Aluminium; Jean-Francois Beland, National Research Council Canada, Canada; and Jerome Fourmann, Rio Tinto Aluminium, USA

EP35

Achieving Mechanical Properties by Using Liquid Nitrogen and Chilled Water: A Special Device
Sutanay Parida, National Aluminium Products Company SAOG, Oman

EP36

Maintenance Guidelines to Enhance the Life of Fixed Dummy Blocks
Sutanay Parida, National Aluminium Products Company SAOG, Oman

EP37

Optimal Billet for a Best Extrusion in AA6063
Sutanay Parida and Ihab Mouallem, National Aluminium Products Company SAOG, Oman

EP38

Factors Affecting Flashing (Mushrooming) of an Extrusion Press
Sutanay Parida, National Aluminium Products Company SAOG, Oman

EP42

The Die Shop of the 21st Century
Yair Levin, Profal Ltd., Israel

EP46

A Study of Fracture of the Ram Protection Ring during the Indirect Extrusion of Aluminum Alloys
Pawel Kazanowski, Hydro Precision Tubing, USA

EP49

Inline Continuous Surface Inspection for Aluminum Extrusion
Björn Biehler, Ascona, Germany; and Brad Allen, iNOEX, USA

EP54

Isothermal Extrusion System and Die Cooling with Liquid Nitrogen
Agostino Sala, S.A.I. SRL Società Automazione Industriale, Italy

EP59

Direct Extrusion of Magnesium: How Lightweight Applications can Benefit from Recently Developed Biodegradable Wrought Alloys
Christian Klose, Leibniz Universität Hannover - Institut für Werkstoffkunde, Germany

EP65

Predict Extrusion Scrap for Quoting
Emily A. Veltman and Justin Clark, Benteler Automotive, USA

EP68

Digitalization in Extrusion – We are Already on the Road
Madhukar C. Pandit, Kaiserslautern University, and Christian Schwarz, 2 HMT Höfer Metall Technik, Germany

EP71

Optimization of Aluminum Extrusions Utilizing Industry 4.0 Strategies
Edward Stiehl, Stiehl Consulting, Norway

EP74

Lateral Angular Co-Extrusion of Aluminum and Steel for the Manufacturing of Coaxial Composite Profiles
Susanne E. Thüerer, Florian P. Schäfke, Bernd-Arno Behrens and Christian Klose, Leibniz Universität Hannover - Institut für Werkstoffkunde; and Johanna Uhe, Leibniz Universität Hannover - Institut für Umformtechnik und Umformmaschinen, Germany

EP77

An Experimental Verification of Thermite Reactions during Extrusion of Aluminum Alloys
Oddvin Reiso, Hilde-Gunn Øverlie, Ulf H. Tundal, Jostein Røyset, and Terje Iveland, Hydro Aluminium, Norway

**EP83**

Improvement of Caustic Bath Performance through Optimized Composition and Process Parameters
Pawel Kazanowski and Joseph Hockenbury, Hydro Precision Tubing, USA

EP84

Maximizing Material Savings through Precision Measurement—Where is my Weight?
Brad Allen, iNOEX; and Bobby Parson, Bonnell Aluminum, Div. Futura Industries, USA

EP86

AA6063 Billet with Reduced Boride Particle Content
Paul Rometsch and Nick C. Parson, Rio Tinto Aluminium, Canada

EP88

Multistep Aging of Extruded 6xxx-Series Alloys
Paul Rometsch and Nick C. Parson, Rio Tinto Aluminium, Canada; and Marco J. Starink, University of Southampton, UK

EP98

Proven Best Practice and Metallurgical Specifications for Controlled Gas Nitriding of Aluminum Extrusion Dies
Jack Kalucki, Nitrex Metal Inc., Canada

EP114

The Effect of Water Temperature on Quench Rates
David Jenista, Granco Clark, Inc.; and Jeffrey Victor, Hydro Extrusion North America, USA

EEP120

Implications and Influence of Extrusion Process Parameters on High-Precision Extrusion
Mushtaq Mohammed, Suresh Annadurai and Mansoor Mohammed, Gulf Extrusions, LLC, UAE

EP128

Understanding the Effect of Quench Delay and Alloy Chemistry on Various 6xxx-Series Alloy Systems
David Shoemaker and Robert A. Matuska, Kaiser Aluminum, USA

EP129

Novel Measuring System for Process and Quality Control in Aluminum Extrusion Plant
Sven Gall, Felix Gensch and Vidal Sanabria, INGWERK GmbH; and Martin Jaehnke and Soeren Mueller, Technische Universität Berlin, Germany

EP137

Comparing Hot-Work Tool Steels Performances for Extrusion Dies
Barbara Reggiani, University of Modena and Reggio Emilia; Lorenzo Donati and Luca Tomesani, University of Bologna, Italy; and Mehdi Ben Tahar, Constellium Research Centre, Brunel University, UK

EP139

Why Die Fails in Extrusion
Hanif Hamzah, Press Metal Berhad, Malaysia

EP140

A Review of Thin-Wall Extrusions
Hanif Hamzah, Press Metal Berhad, Malaysia

EP141

Liquid Nitrogen Experience in Using AA6060, AA6063 & AA6005A
Hanif Hamzah, Press Metal Berhad, Malaysia

EP144

Back-to-Front Variations in a Typical Extruded Material AA6063
Abu Bakar Sugianto, Press Metal Berhad, Malaysia

EP152

Additive Manufacturing of H-13 Inserts for Optimal Extrusion Die Cooling
Lorenzo Donati, Giuseppe Valli, Ivan Todaro, Rosario Squatrito, and Luca Tomesani, University of Bologna; Barbara Reggiani and Riccardo Pelaccia, University of Modena and Reggio Emilia; Tommaso Pinter, Almax Mori SrL.; and Enea Mainetti, A.t.i.e. Uno Informatica SrL., Italy; and Yoram Rami, Alubin, Israel

EP155

Effect of Inverse Segregation on Extrusion Press Recovery
Saurabh Sedha and Jerome Fourmann, Rio Tinto Aluminium, USA; and Nick C. Parson, Rio Tinto Aluminium, Canada

EP175

Influence of Extrusion Parameters and Alloy Additions on Structure and Mechanical Properties of 7xxx-Series Alloys
Bartłomiej Plonka, Lukaszewicz Research Network – Institute of Non-Ferrous Metals, Light Metals Division, Poland

TH: Extrusion/Die Theoretical Track

TH8

Extrusion Productivity – Ram Speed/ Container/Die
Paul H. Robbins and Yahya Mahmoodkhani, Castool Tooling Systems; Chris Jowett, Rio Tinto Aluminium, Canada; and Richard Dickson, Hydro Aluminum, USA

TH17

Microstructural Changes in Al-Mg-Si Alloys through the Extrusion Process Chain
Eva A. Mørtzell, Takeshi Saito, Endre A. Hennum, and Oddvin Reiso, Hydro Aluminium R&D; Calin D. Marioara, SINTEF Materials and Nanotechnology; Randi Homestad, NTNU; and Ulf Tundal and Jostein Røyset, Hydro Aluminium, Norway

TH19

Real-Time Simulations of Properties of 6xxx-Series Extruded Profiles
Geir Øyen, Ole R. Myhr and Øystein Bauger, Hydro Aluminium R&D; Rune Østhus, SINTEF Manufacturing; and Trond Furu, Norsk Hydro, Corporate Technology Office, Norway

TH22

Modeling of Recrystallization, Quench Sensitivity and Surface Tearing of 6xxx-Series Alloys
Ole R. Myhr, Hydro Aluminium R&D; Rune Østhus, SINTEF Manufacturing; Anders Nesse, Norwegian University of Science and Technology; and Trond Furu, Norsk Hydro, Corporate Technology Office, Norway; and Kai Zhang, Hydro Extruded Solutions, Innovation & Technology, Sweden

TH29

Numerical Simulation of Continuous Rotary Extrusion of AA6061 Flat Sections

Nijenthnan Rajendran and Wojciech Z. Misiolek, Lehigh University, USA; and Monika Mitka and Marzena Lech-Gregg, Institute for Non-Ferrous Metals, Poland

TH32

The Effect of Press Quench Rate on Grain Boundary Precipitation and Fracture Behavior of 6xxx-Series Extrusion Alloys

Warren Poole, Mojtaba Mansouri Arani and Zhijun Zhang, The University of British Columbia; and Nick C. Parson, Rio Tinto Aluminium, Canada

TH45

Temperature Evolution during Direct Extrusion of Magnesium and Its Alloys AZ31 and AZ80

Jonas Isakovic, Jan Bohlen and Karl Ulrich Kainer, Helmholtz-Zentrum Geesthacht; and Noomane Ben Khalifa, Leuphana University of Lüneburg, Germany

TH50

The Effect of Bridge Geometry during Porthole Extrusion on the Mechanical Properties of 6xxx-Series Alloys

Yu Wang and Mary A. Wells, University of Waterloo; Yahya Mahmoodkhani, Castool Tooling Systems; Jingqi Chen and Warren Poole, University of British Columbia; and Nick C. Parson, Rio Tinto Aluminium, Canada; and Mei Li, Ford Motor Company, USA

TH55

Comprehensive Extrusion Technology Development: Process Simulation Integrated with Die Design and Product Quality Control

Nikolay Biba, MICAS Simulations Ltd., UK; Tom Ellinghausen, Forge Technology, Inc., USA; and Ivan Kniazkin and Sergey Stebunov, QuantorForm Ltd., Russian Federation

TH61

Die Development and Mechanism for the Extrusion of Hollow Profiles with Axial Variable Wall Thickness

Maik Negendank, Vidal Sanabria and Soeren Mueller, Extrusion R&D Center, TU Berlin; and Walter Reimers, Metallic Materials, TU Berlin, Germany

TH72

The Equal Channel Angular Reverse Pressing Process and Its Influence on the Microstructure of Pure Magnesium and AZ31

Florian P. Schöpfke, David Kramer, Susanne E. Thüerer, and Christian Klose, Leibniz Universität Hannover - Institut für Werkstoffkunde, Germany

TH75

Investigation of Profile Temperature Evolution during Extrusion of AA6005A

Vidal Sanabria and Sören Müller, Technische Universität Berlin; and Dong-zhi Sun, Fraunhofer-Institut für Werkstoffmechanik IWM, Germany

TH81

Production of Sheets by Hot Extrusion of Aluminum Chips

André Schulze, Christoph Dahnke and A. Erman Tekkaya, Institute of Forming Technology and Lightweight Components, Germany

TH82

Influence of Extrusion Process Parameters on Microstructure and Mechanical Properties of Aluminum Profiles

Dong-Zhi Sun, Andrea Ockewitz and Florence Andrieux, Fraunhofer Institute for Mechanics of Materials IWM; and Soeren Mueller, Extrusion Research and Development Center, TU Berlin, Germany

TH104

Numerical Simulation of Thermomechanical Straining of AA6060 Extrusions

Steven Babaniaris and Matthew R. Barnett, Institute for Frontier Materials - Deakin University; and Aiden Beer, School of Engineering - Deakin University, Australia

TH105

The Effect of Scandium and Zirconium on the Strength-to-Extrudability Trade-Off in Al-Mg-Si Alloys

Thomas Dorin, Steven Babaniaris and Mahendra Ramajayam, Institute for Frontier Materials - Deakin University; and Timothy P. Langan, Clean TeQ Ltd., Australia

TH112

Prediction of Back-End Scrap in Direct Extrusion by Means of Finite Element Analysis

Tommaso Pinter, Almax Mori SrL.; Barbara Reggiani and Riccardo Pelaccia, University of Modena and Reggio Emilia DISMI; and Lorenzo Donati, University of Bologna, Italy

TH117

Introduction of Intrinsic Hot Aluminum-Polymer Extrusion

Johannes M. Gebhard, Oliver M. Hering, Fabian Günther, Christoph Dahnke, Markus Stommel, and A. Erman Tekkaya, TU Dortmund, Germany

TH121

Improvement of Wear Resistance and Friction on Extrusion Dies Combining TriboWearTester and Finite Element Analysis

Joachim Maier, WEFA Cedar Inc., USA; and Verena Merklinger, HTWG Konstanz, Germany



**TH122****Die Corrections & Die Design Enhancement Using Profile Simulation in Extrusion Industry**

Suresh Annadurai, Mushtaq Mohammed and Imran Mulla, Gulf Extrusions, LLC, UAE

TH138**Modeling of Nitrogen Cooling in the Extrusion of Aluminum Alloys**

Riccardo Pelaccia and Barbara Reggiani, University of Modena and Reggio Emilia; and Lorenzo Donati and Luca Tomesani, University of Bologna, Italy

TH146**Ultra-High Conductivity Aluminum Alloys with Graphite Nanoparticles**

Aditya K. Nittala and Frank Kraft, Ohio University; and Keerti S. Kappagantula, Pacific Northwest National Lab, USA

TH151**A Review of Finite Element Method Code Accuracy for Reliable Extrusion Process Analysis: ICEB Extrusion Benchmark Conference 2017**

Lorenzo Donati and Luca Tomesani, University of Bologna; and Barbara Reggiani, University of Modena and Reggio Emilia, Italy

TH165**Analysis of the Extrusion Pressure Curve to Monitor and Stabilize the Alloy Extrusion Process**

Giacomo Mainetti, Marcelo Aiello, Massimo Bertoletti, Enea Mainetti, and Teodoro Mainetti, ATIE Uno Informatica, Italy; and Bernard Bourqui, Nicolas Fietier and Olivier Rey, M-TD SA, Switzerland

TH166**Bearing Profile and Shape Optimization of Aluminum Extrusion Dies**

Narendra Singh, Garima Singh and R. Mayavaram, Altair Engineering, USA

TH 168**Experimental and Computational Analysis of Hybrid Additively-Manufactured Extrusion Dies with Cooling Channel Integration**

Chiara Bertoli and Pavel Hora, ETH Zurich/Institute of Virtual Manufacturing; and Joachim Maier, WEFA Swiss AG, Switzerland

TH 169**Modeling of Extrusion Welding Conditions for Aluminum Alloys**

Dariusz Lesniak and Pawel Gromek, AGH University of Science and Technology, Poland

TH171**Forecasting Seam Weld Quality during Extrusion of Aluminum Hollow Profiles through Numerical and Experimental Approaches**

Michele Crosio and Pavel Hora, ETH – Institute of Virtual Manufacturing, Switzerland

MI: Management Issues Track**MI1****ETs: Leading Technology for 50 Years; Harvesting Valuable Information from the First ET in 1969**

Craig Werner and Robert A. Matuska, Kaiser Aluminum, USA

MI3**Automotive Consumption of Lightweight Materials and the Impact of Electric Vehicles**

Roberto Boeker, AluMag Automotive, USA

**MI28****To Cast or Not to Cast, a Review of Recent Industry Impacts to Billet Manufacturing**

Jim Madgett, Almex USA Inc., USA

MI39**Recycling Post-Consumer Scrap into High-Quality Extrusion Ingots**

Stig Tjoetta, Hydro Aluminium, Norway; and Ludovic Dardinier, Hydro Aluminium Clervaux, Luxembourg

MI43**A Digital Twin for Production of Aluminum Extrusions**

Trond Furu, Norsk Hydro ASA; Rune Østhus, SINTEF Manufacturing; and Ole Runar Myhr, Hydro Aluminium, Norway

MI52**Die Ordering Documentation and Characteristics of a Good Die Supplier**

Sutanay Parida, National Aluminium Products Company SAOG, Oman

MI53**LME Fluctuation Impact on Profit and Loss of Business**

Ihab Mouallem and Sutanay Parida, National Aluminium Products Company SAOG, Oman

MI56**Preventive Maintenance Strategies Using Machine Learning**

Daniel Meier, Tobias Frick and David Beinder, MCE, Liechtenstein

MI87**Maintaining Traceability of Extruded Lots**

John Stenger, Foy Inc., USA

MI89**Attracting and Developing Talent for the Aluminum Extrusion Industry**

Duncan Crowdis, Alexandria Industries; and Lynn Brown, Long Point Associates, USA

MI95

The Benefits of Bar Code and RFID Scanning in Managing Extrusion Production Information

Scott L. Wilson, Foy Inc., USA

MI96

3D-iExtrusion Mitigates Climate Change with Energy-Efficient 3D-Profiles for Energy, Production, Transportation, and Construction/Housing

Mark J. Kragh, Relieved AB, Sweden

MI97

Customer Technical Support from an R&D Perspective

Jostein Røyset, Hydro Aluminium Primary Metal, R&D Extrusion Ingot; and Eskild Hoff, Hydro Aluminium Technology Center, Norway

MI115

Improving Maintenance Efficiency

James A. Kennedy, Kennedy Eurotech Inc., USA

MI135

Safety Standards and Ergonomic Improvements in Material Handling

Raffaele D'Andrea, Emmebi SrL., Italy

MI136

Quality Management Plays a Central Role in Aluminum Extrusion Industry 4.0

Michael Hoenen, ISRA Parsytec GmbH, Germany

MI149

Journey of an Architectural Extrusion to an Automotive Extrusion Plant

Mansoor Mohammed, Mushtaq Mohammed and Arif Husain, Gulf Extrusions, LLC, UAE

MI156

How the Aluminum Industry can Help Customers Reduce their CO₂ Emissions and Environmental Imprint with 3D-iExtrusion, Optimization and Integration

Mark J. Kragh, Relieved AB, Sweden

MI157

Automation is More than Bolting Mechanics to a Press

Richard F. Dickson, Hydro Aluminium Metals; Brian Echavarria, Hydro Aluminium; and Carsten Dede, OMAV, USA

MI162

Racing for Performance: Comparison of Three Extruders' Countries

Abubakar Subiantoro, Extruders & Sheet & Foil Aluminium Association, Indonesia

MI163

A Fine Balance, the Difference between Excellence and Mediocrity

Richard F. Dickson, Hydro Aluminium Metals, USA; and Paul H. Robbins, Castool Tooling Systems, Canada

VA: Value-Added Processes Track

VA2

Structural Design of Extrusions in the 2020 Aluminum Design Manual

Randy Kissell, Trinity Consultants, USA

VA5

Accelerated Light Fastness Testing of Anodic Coatings

Pinakin Patel and Tej Patel, Techevon LLC, USA

VA15

New Cavity Designs and Thermal Barrier Materials for Increased Thermal and Structural Capabilities in Fenestration

Jerry Schwabauer, Azon, USA

VA20

Influence of Trace Elements and Temper Conditions on Spangling and Gloss on Anodized Aluminum Profiles

Øystein Bauger, Hans Bjerkaas, Tom Hauge, Snorre K. Fjeldbo, and Oddvin Reiso, Hydro Aluminium, Norway

VA26

Technical Solutions of Rotative Anodizing for Aluminum Extrusion Profiles

Elia Schaer, Alvarez Schaer S.L.U., Spain

VA27

New Eco-Friendly Sealings at Low Temperature

Alberto Abad, Alvarez Schaer S.L.U., Spain

VA30

Automation and Industry 4.0 in Thermal Break Assembly

Remco Dumortier, Aluro, Belgium

VA40

Aluminum-Intensive L7e Micro-Car Concept Study

Stig Tjoetta and Lars Moen, Hydro Aluminium, Norway; Leif Hagebeuker, Hydro Aluminium Extruded Solutions; Klaus Vieregge, Hydro Aluminium Rolled Products; and Rainer Wolsfield, fka GmbH, Germany

VA51

Shipping Container Loading-Unloading Solution: A Smart Giant Pallet Truck

Sutanay Parida, National Aluminium Products Company SAOG, Oman

VA58

A Virtual Tool to Predict Damage and Failure of Extruded Components for Crash Applications

Jean-François Béland and Guillaume D'Amours, National Research Council of Canada; and Nick C. Parson, Rio Tinto Aluminium, Canada

VA60

The Evolution of Vertical Powder Coating

Andrea Trevisan, SAT SrL., Italy

VA78

Special Effects in Anodizing: The New Trends in Europe

Marcello Rossi, Walter Dalla Barba, Alberto Brandoli, and Fabio Vincenzi, Italtelco SrL., Italy

VA79

Investigation of Longitudinal Weld Streak Defects on Anodized Aluminum Profiles

Johannes M. Gebhard, Christoph Dahnke, and A. Erman Tekkaya, TU Dortmund, Germany

**VA85****Method for Improving the Load-Bearing Capacity of Welded Aluminum Extrusions**

Rune Oesthus, SINTEF Manufacturing; Anne Hamarsnes, NTNU; Ole R. Myhr, Hydro Aluminium R&D; Hallvard G. Fjaer and Dag Lindholm, IFE; and Trond Furu, Norsk Hydro ASA, Norway

VA92**Effects of Variations in Alloying Element Concentrations on the Anodization and Finish of AA6063**

George N. Oh and Nathan H. Sheffield, Houghton International, USA

VA93**Increasing the Amount of Trace Elements in Recycled 6xxx-Series Alloys**

Alexander Lutz and Iris De Graeve, Vrije Universiteit Brussels; and Hendrik Claes, Carlos Kampen and Dimitri Fotij, E-MAX, Belgium

VA94**Improved Corrosion Resistance of Round Tube Plate Fin Heat Exchangers by Alloy Selection**

David Ellerbrock, Hydro Extruded Solutions, USA; and Esma Senel, Jan Halvor Nordlien, Xiao-Jun Jiang, and Bard Fiskum Lillestol, Hydro Extruded Solutions, Norway

VA99**Innovative Approaches in Metalworking Fluid Development**

Yixing (Philip) Zhao, Shilpa Beesabathuni and Dave Slinkman, Houghton International, USA

VA100**Powder-Coated Tough: High-Performance Applications for Aluminum Surfaces**

Trena Benson, Powder Coating Institute; and Fiona Levin-Smith, IFS Coatings, USA

VA108**Incremental Extrusion Stretch Forming for Lightweighting Applications**

Hal Plueneke, Fairmount Technologies LLC, USA

VA109**The Way from Digitalization towards a Digital Ecosystem: Aluminum Extrusion Technology: A Use Case**

Franck Komi Adjogble, Dieter Stotski and John Bergman, SMS group Inc., USA

VA111**Rectifiers and Controls for the Aluminum Anodizing Process – Latest Developments**

Frank Munk, Munk GmbH, Germany

VA116**New Method for Correlating Etch Rate to Fluoride Activity**

Scott A. Wojciechowski, Bulk Chemicals Inc., USA

VA118**Metallurgical Assessment of Acid Etch as an Anodizing Pretreatment**

Jerome Fourmann, Rio Tinto Aluminium, USA; and Nick C. Parson and Marc Lebleu, Rio Tinto Aluminium, Canada

VA124**Mechanism of Grit Formation on Aluminum Extrusions**

Xinquan Zhang and Marcos Varayud, Rio Tinto Aluminium; and Christopher East and Natalia Danilova, Queensland University of Technology, Australia

VA125**A New Cost- and Energy-Efficient Technology for Extrusion-Based Additive Manufacturing of Near-Net Aluminum Alloy Shapes**

Jørgen Blindheim, Torgeir Welo and Geir Ringer, NTNU, Norway

VA132**Innovative Solution for Protection and Packing of Aluminum Profiles**

Raffaele D'Andrea, Emmebi Srl., Italy

**VA133****Fully-Automatic Robot Packing**

Raffaele D'Andrea, Emmebi Srl., Italy; and Damir Merdovic, Capral Aluminum; and Paul Wong, Applied Robotics, Australia

VA134**Use of IoT for Aluminum Profile Fabrication Shops**

Romina Giardi and Giovanni Barbareschi, FOM Industrie Srl., Italy

VA142**Cost-Effective, Precision Calibration of Aluminum Extrusions for Automotive Applications**

Torgeir Welo, NTNU, Norway

VA150**Enhancements in Anodizing Line to Improve the Plant Capacity and Conserving Natural Resources – Energy-Efficient Process**

Mansoor Mohammed, Mushtaq Mohammed and Arif Husain, Gulf Extrusions, LLC, UAE

VA153**Framework for Predicting Dimensional Accuracy of 3D-Formed Aluminum Profiles Based on Closed-Loop Data Management**

Torgeir Welo and Geir Ringer, NTNU, Norway

VA167**Advancements in the Manufacture of Large Deck Panels by Friction Stir Welding of Extrusions**

Dave Hofferbert, Bond Technologies, Inc., USA

VA172**An Aluminum Oxide Thermal Variable Process**

Walt Ahland, Lights Camera Action, LLC, USA

VA173**Thermal Break Advancements to Increase Production and Reduce Labor**

Scott Kochevar, FomUSA, USA; and Marco Cigarini, Comall International Srl, Italy

Add-On Education at ET '20

In-conjunction workshops and courses from aluminum industry organizations provide convenient and value-added learning opportunities for you and your team. Add one or more of these practical seminars to your ET '20 week – **on Monday, May 18 and/or Friday, May 22, 2020.** Register early, as space is limited; registration includes lunch and all course materials. For complete course information visit **ET20.org**.

Monday, May 18

Process Analysis and Optimization



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

8:30 a.m. – 5:00 p.m.

This one-day workshop is conducted by top experts from the Manufacturing Technologies Group at the University of Bologna, Italy. Topics covered include Introduction to Practical and Analytical Extrusion Concepts, Material Flow and Friction in Direct Extrusion, Die Failure Modes and Die Life Prediction, and much more.

Fee: \$450

Anodizing Essentials

8:30 a.m. – 5:00 p.m.



ALUMINUM
ANODIZERS
COUNCIL™

The Aluminum Anodizers Council's Level 1 Course, *Anodizing Essentials Workshop*, details the foundation of quality anodizing from beginning to end. AAC anodizing experts designed this program, which will benefit production personnel at every level, from veterans to newcomers alike. The program includes such topics as metallurgy basics, cleaning and rinsing, racking, dyeing, sealing, power for the aluminum surface treatment industry, safety and much more.

Fee: \$450 (for AAC Members / \$800 for Non-Members)

Monday or Friday, May 18 or 22

Extrusion Excellence: Applied Fundamentals for Aluminum Extruders

8:00 a.m. – 5:00 p.m.



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Theory and practice combine in this intensive one-day course that presents a fundamental engineering approach to the aluminum extrusion process, covering the manufacturing process from billet production through the press to the runout table. This course will benefit those new to the industry, as well as experienced production personnel. Course topics include Extrusion Concepts, Aluminum Extrusion Alloys, Aluminum Billet Metallurgy, Extrudability, and much more.

Fee: \$450 (AEC Members only. Please specify Monday, May 18 or Friday May 22 when registering.) Register early; registration is limited to 30 attendees each day.

Friday, May 22

AEC Die Clinic

8:00 a.m. – 5:00 p.m.



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The AEC Advanced Die Clinic goes beyond basics to address more advanced concepts for professionals with some experience in the Die Shop. Receive hands-on learning from industry veterans who have dealt with the challenges and issues that you face every day. General Sessions and interactive breakout sessions cover relevant extrusion die topics. Breakout sessions are led by AEC Die & Tooling Team members – extruders and die-making experts who readily share key insights and their most valuable experiences, providing the best and most practical training in the industry.

Fee: \$450 (Registrants must be AEC Members)

Extrusion Design University 2020 – EDU '20

8:30 a.m. – 5:00 p.m.

EDU is an educational event created to expand knowledge of aluminum extrusion design, technology and applications. From alloys and applications to paint and fabrication, the program enables professionals to better understand how to design and use extrusions to their best advantage. Aluminum extrusion industry experts lead one-hour sessions, many of which are available for continuing education units (CEUs) and professional development hours (PDHs).

Fee: \$200 (EDU '20 Only; or free combined with ET '20)



Produced
by:



**Extrusion Technology
for Aluminum
Profiles Foundation**

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**REGISTRATION FORM****May 19 – 21, 2020 • Orlando, Florida USA**

Use this form for individual or team registrations. Only those registered may attend scheduled functions. Registration fee includes all as-registered program sessions, entrance to ET Expo, one copy of the ET '20 Proceedings (digital) on flash drive per registered delegate (non-exhibitor), and scheduled networking and meal functions. (Printed ET '20 proceedings will be available for purchase after ET.)

The following educational workshops and special events will be offered as optional add-on events during ET '20. See inside for details.

Registration Fees	Early	Standard
<i>U.S. Funds only</i>	On or by March 16, 2020	After March 16, 2020
<input type="checkbox"/> Individual	\$ 1050	\$ 1150
<input type="checkbox"/> Team *	\$ 975	\$ 1075

***TEAM DISCOUNT:** Companies sending 5 or more delegates will qualify for the Team Discount. All registrations and payment must be sent together. If cancellation occurs, and fewer than 5 delegates attend, the appropriate fee will be charged. Discount applies to ET '20 registrations only. Delegate substitutions may be made at any time.

Event #	Fee
1. Process Analysis & Optimization Workshop	\$ 450 / Monday
2. Anodizing Essentials Workshop	\$ 450 / AAC Members / Monday \$ 800 / Non-Members / Monday
3. Extrusion Excellence: Applied Fundamentals	\$ 450 / Monday
4. Extrusion Excellence: Applied Fundamentals	\$ 450 / Friday
5. AEC Advanced Die Clinic	\$ 450 / Friday
6. Extrusion Design University –EDU '20	\$ 200 / Friday / Stand-alone Or Free with ET '20 Registration
7. ET '20 Anniversary Celebration Dinner Show	\$ 95 / Thursday
8. ET Founders Golf Tournament	\$ 155 / Friday / \$48 Equip. Rental
9. Kennedy Space Center Tour	\$ 95 / Friday

Step 1: Company Information

Complete this section for individual delegates and team registrations.

Company _____

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Zip/Postal Code _____ Country _____

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☐ Opt Out: **Do not** send my information to any third party.

☐ Check here if you have a disability and require accommodation to fully participate. (Staff will contact you.)

Please include ONE Code (see Step 2) to indicate your PRIMARY job responsibility next to your name.

EXTRUDERS ONLY

- 11 Executive Management
- 12 Plant Manager
- 13 Research & Development
- 14 Metallurgist
- 15 Designer
- 16 Engineer
- 17 Sales & Marketing
- 18 Quality Assurance
- 19 Die Maker/Corrector
- 20 Production
- 21 Finishing
- 22 Fabrication
- 23 Casting/Remelt
- 24 Packaging/Shipping
- 25 Plant Engineer
- 26 Financial
- 27 Safety
- 28 Environmental
- 29 Other

SUPPLIERS ONLY

- 31 Executive Management
- 32 Research & Development
- 33 Equipment Designer
- 34 Engineer
- 35 Sales & Marketing
- 36 Installer
- 37 Other

END-USERS ONLY

- 41 Executive Management
- 42 Research & Development
- 43 Product Designer
- 44 Engineer
- 45 Sales & Marketing
- 46 Manufacturing/Promotion
- 47 Other

OTHERS

- 51 Educator
- 52 Student
- 53 Non-Profit Organization
- 54 Researcher
- 55 Media/Press
- 56 Other

Step 2: Delegate Information

Complete this section for each delegate who will be attending. Individual email addresses MUST be provided for registration confirmation purposes.



JOB CODE	First Name	Last Name	Job Title	Email	ET '20 Fee	Event # & Fee	Event # & Fee	Subtotal
1.						\$	\$	\$
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3.						\$	\$	\$
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5.						\$	\$	\$

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NOTE: Do not email your form with credit card information! For your protection, all credit card information should be sent via our secure fax. You may also mail your payment. Any registration forms sent via email will not be processed and will be automatically deleted. For convenience and greater security, register online at ET20.org.

METHOD OF PAYMENT

- ☐ Check enclosed (make check payable to Aluminum Extruders Council; U.S. Funds drawn on a U.S. bank only)
- ☐ Wire transfer (include complete registration total and applicable bank fees in U.S. Dollars)

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