Organized by:

American Business Conferences





 $(\mathbf{0})$

29 OCTOBER - 30 OCTOBER 2019 | ATLANTA, GEORGIA

Joining Technologies & Methodologies For Improving Manufacturability - Including Fastening & Welding Of Gen3 Steels & High Strength Aluminum Grades

Optimizing Adhesive Joining Applications For Lightweighting Multi-Material Body Structures

Headline & Workshop Sponsor

Co-Sponsor

United States Steel





Networking Break Sponsors

machines unlimited

www.automotive-lightweight-materials-manufacturing-south.com

()

LOCTITE. **BONDERITE TEROSON**



۲

Lose the Weight. Keep the Performance, Safety and Reliability

HENKEL CORPORATION 32100 Stephenson Highway Madison Heights, MI 48071 1.866.322.7024

www.henkel-adhesives.com/us

All marks used are trademarks and/or registered trademarks of Henkel and its affiliates in the U.S. and elsewhere. @ = registered in the U.S. Patent and Trademark Office. © 2019 Henkel Corporation. All rights reserved. DSGN0001728 (9/19)





American Business Conferences

ADVANCED LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE MANUFACTURING & JOINING INNOVATION

۲

Dear Colleague,

It is our pleasure to welcome you to the premiere Advanced Lightweight Materials For Automotive Manufacturing & Joining Innovation Southern States Congress, a GALM Series Event.

First of all, we would like to extend our special thanks to all of this year's speakers, partners, sponsors and contributors who have agreed to share their expertise and experiences with us over the course of the next two days. It is the ever-growing network, collaborations, alliances and benchmarking between OEMs, technology innovators and systems suppliers that continue to drive automotive industry advancements globally.

The transition by automotive OEM's to a new generation of EVs, Hybrids and ICEVs is placing increased emphasis on use of break-through technologies for lightweight vehicle manufacturing processes and integrated assembly. With brand new agenda, this year's Summit will, over two-days, explore new manufacturing technologies and solutions being adopted including multi-material components, structures and joining and forming solutions to achieve mass reduction, optimize structural integrity, as well as exploit digitalization of manufacturing under industry 4.0 for smarter, more agile production and improved profit margins.

Special thanks are due to the **Headline and Workshop Sponsor**, **Henkel**, as well as **Co-Sponsor United States Steel, Galaxy Trade Technology Corporation** and **Network Break Sponsors DEPRAG, ESI** and **Hydro**, as well as all our exhibitors.

Please take time to visit the sponsors and exhibitors in the exhibition area during the breaks and networking sessions to understand the technology innovations, solutions and light weighting developments they offer. To enable even more networking, we are pleased to announce there will be a **Drinks Reception** at the **End of Day One** in the exhibition area.

Documentation and Presentations: This booklet contains the two-day agenda. To access the presentations, please use the following link:

www.lbcg.com/event-downloads/c771/ALM19 Password: ALM19

Complete the Delegate Feedback form – Take part in the Amazon Echo prize draw!: We would much appreciate your feedback to assist us in improving and planning future events including agenda content and speakers. If you do not wish to state your name, your response will still be greatly welcomed. A prize draw will be made from the submitted feedback forms at the end of the Summit.

Business Card Draw at the close of Day 2 – Win a Bottle of Champagne! Please drop your business card in the bowl at the registration desk for your chance to win!

To help you make the most of the proceedings, we highly encourage you to present your questions to the speakers following the presentations and panel discussions to ensure everyone benefits from a fully interactive conference on the day. We hope you enjoy the conference and take full advantage of the networking opportunities over the next two days.

Kind regards,

۲

nglhangt

Michael Cherrington

Conference Director, Content Lead and Technology Specialist, Advisory Board Co-ordinator GALM and BEVA Automotive Portfolio michael.cherrington@lbcg.com LOUNDERMILK WIFI Username: LCC Password: iluvmeeting



www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com

()

 (\bullet)

DAY 1 TUESDAY October 29, 2019

07:30 Coffee and Registration

09:00 Chair's Welcome And Introduction

Antonio Mercado, Advanced Manufacturing Engineer, Manager Body, Karma Automotive

Cost Effective Lightweighting & Joining Methodologies For Improving The Manufacturability Of Mixed Metals & Dissimilar Materials

OPENING PANEL - OEM SENIOR MANUFACTURING ENGINEER PERSPECTIVES

08:40 Implementing Transformative Technology For Reducing The Cost And Improving The Quality Of Mixed Metal Joining - What Are The Latest Technologies Used For Mass Market Applications In BEVS, Hybrids And ICEVs?

- Comparing different methods of joining aluminum to steel in terms of costs and payback
- Best practices specifically on joining of new high strength steels and aluminum alloys
- How to manage the joining process with different coatings and interfacial treatments
- Achieving a balance between lightweighting, vehicle performance and corrosion performance for EVs and autonomous vehicles

Ken Gould, E-Mobility Technical Systems Engineer, Porsche Cars North America (focus on Taycan)

Dan Panoz, Founder and President, Panoz

۲

Prof. Dr.-Ing. Sama Mbang, Leader, European Affordable Lightweight Automobiles Alliance Project, Daimler Mercedes-Benz

Antonio Mercado, Advanced Manufacturing Engineer, Manager Body, Karma Automotive

Hank Bonutti, Advanced Technology Manager, Mahindra North American Technical Center

Oliver Kuttner, CEO And Founder, Lightweighting Engineer, Edison2

HEADLINE SPONSOR PRESENTATION

10:00 Lose Vehicle Weight, Keep Performance, Safety And Reliability

- BIW optimization and hybrid structural solutions to achieve crash performance targets
- Structural adhesives, bonding and sealing to meet demanding performance requirements
- Thermal conductive adhesives and bonding with functional heat management
- Key chemistry solutions including liquid gasketing applications for electronics

Bashar Kirma, Senior Business Development Manager, Powertrain and eMobility, Henkel Corp.

10:30 Questions and Discussion

10:40 Networking Coffee Break in Exhibition Area. Sponsored By Hydro

۲

HIGH STRENGTH STEEL ADVANCES

11:15 Implementing XG3 Steel Today And In The Future

Michael Davenport, Director of Applications Engineering, United States Steel 11:45 Questions and Discussion

PANEL - HIGH STRENGTH STEEL MANUFACTURABILITY

11:55 Improving The Manufacturability Of Gen3 And High Strength Steels

- Updates on grades including hot-dip galvanized 980 Gen3 as well as commercialization of next generation boron and ultra high strength steels.
- boron and ultra high strength steels.Improving simulation of fatigue and fracture failure
- characteristics of Gen3 and other high strength steels
 Solutions for manufacturing integration including improved LME resistance
- Future of lightweight steels for EVs

Dr. Hesham Ezzat, Program Manager, American Iron and Steel Institute (AISI) Hank Bonutti, Advanced Technology Manager, Mahindra North American Technical Center Antonio Mercado, Advanced Manufacturing Engineer, Manager Body, Karma Automotive Michael Davenport, Director of Applications Engineering, United States Steel

12:45 Networking Lunch In Exhibition Area

HIGH STRENGTH LIGHTWEIGHT MAGNESIUM ALLOYS

13:45 Magnesium Alloys And The Future Of Automotive Lightweighting For Electric And Autonomous Vehicles

- the role of magnesium in an evolving ecology of industrial lightweighting materials -- complementing steel, aluminum and composites
- results of recent research in micro-alloying, using nano particle precipitation to produce new mg alloys; announcing new ZA81M alloy
- benchmark tests showing advantages in tensile strengh, ductility, anti-fatigue, elongation performance
- call for increased international cooperation with leading science and engineering groups in China

Introduction:

Michael North, Founding Board Chairman, Galaxy Trade and Technology Company Presenter:

Dr. Yang Yuansheng, team leader, magnesium lightweighting engineering, China Institute of Metal Research, Shenyang; part of Chinese Academy of Sciences

14:30 Questions and Discussion

JOINING CASE STUDY: FLOW SCREW PROCESS

14:45 Innovations In Flow Screw Fastening For Joining Mixed Metals & Dissimilar Materials Aluminum, Carbon Fiber And Steel For Lightweight EV Structures

- Developments in flow screw installation process and equipment
- Joining aluminum and carbon fiber to each other and to steel
- Implications for mechanical fastening approaches with the adoption of Industry 4.0, increased automation and automated assembly cells

• Fastener strategy for EVs and autonomous vehicles **Boris Baeumler**, Senior Applications Engineer,

DEPRAG

15:15 Questions and Discussion

15:25 Networking Coffee Break In Exhibition Area - Sponsored by

OPTIMIZING LIGHTWEIGHT VEHICLE DESIGN

15:50 Looking Ahead To Potentially Disruptive Technologies And Materials For Lightweighting

Oliver Kuttner, CEO And Founder, Lightweighting Engineer, Edison2

16:15 Questions and Discussion

16:20 Advances In Composite Materials Manufacturing Processes For High Quality Components With Increased Throughput And Lower Cost

Dr. Srikanth Pillai, Jenkins Endowed Professor, CU-ICAR and Founding Director, Clemson Composites Center

16:50 Questions and Discussion

PANEL - ADHESIVE TECHNOLOGY AND APPLICATIONS INNOVATION

16:55 Application Of Special Adhesives For Steel, Aluminum, Magnesium And Carbon Fiber

- How do we lightweight the whole joining process?
- What are the trends in reducing complexity with flange design, mechanical fastenings, welding and adhesives?
- Understanding adhesive flow processes under welding
- Role of adhesives in corrosion protection, stiffness and managing noise vibration and harshness (NVH)
- Innovation with metallic fiber-reinforced adhesive bonded joints for improved stress distribution and toughness

Hank Bonutti, Advanced Technology Manager, Mahindra North American Technical Center

Henkel

Dr. Srikanth Pillai, Jenkins Endowed Professor, CU-ICAR and Founding Director, Clemson Composites Center

17:30 Chair's Closing Remarks - Day 1

17:40 - 18:40 Networking Drinks Reception For All Attendees

www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com

DAY 2 WEDNESDAY October 30, 2019

08:00 Coffee and Registration

09:00 Chair's Welcome And Introduction

Hank Bonutti, Advanced Technology Manager, Mahindra North American Technology Center

Manufacturing Processes Innovation For Lightweight Structures Including Joining And Forming With Aluminum And Composites

LIGHTWEIGHTING FOR AFFORDABLE AND EFFICIENT VEHICLES

09:10 Progress Towards New Lightweight Materials And More Efficient Manufacturing Processes For The Next Generation Of Vehicles: Update On Europe's ALLIANCE Project

- Adopting a holistic approach to affordable and effective lightweighting
- Development of novel advanced materials
- Innovative manufacturing technologies
- Mass optimizer software tools and multi-parameter design methodology
- Plans for real vehicle demonstrators including implementation of optimized modules
- Developing an open inclusive framework and central hub for lightweight design in Europe

Prof. Dr.-Ing. Sama Mbang, Leader, European Affordable Lightweight Automobiles Alliance Project, Daimler Mercedes-Benz

09:50 Question And Answer Session

MODELING MANUFACTURING PROCESSES

۲

10:00 Adopting The Latest Advances In Simulation And Modeling Of Manufacturing Processes To Reduce Production Costs And Minimize Physical Testing

- Innovations in predictive modeling of welding, stamping and adhesive joining processes to reduce physical testing processes
- Modeling of material properties for crashworthiness testing
- Simulating the assembly line to ensure throughput and clearances
- Benefits in bringing new manufacturing plants and production online quicker

Dr. Ing. Fouad el Khaldi, Strategy & Innovation General Manager, ESI Group

10:30 Questions and Discussion

10:40 Networking Coffee Break In Exhibition Area - Sponsored by

CASE STUDY - KARMA AUTOMOTIVE

11:10 Karma Automotive Open Platform Strategies Supporting Future Needs

- Internal capabilities and partner collaborations
- EV with an on-board generator
- 2020 Karma Revero GT
- New platform strategy
- Future directions and innovation Project E-Klipse customizable platform
- Seamless integration between product and manufacturing design

Antonio Mercado, Advanced Manufacturing Engineer, Manager Body, Karma Automotive 11:40 Questions and Discussion

PANEL - COMPOSITE STRUCTURES

۲

11:50 Composite Materials Applications For Enhanced Lightweight Body Structures

• Lightweighting opportunities for composites in

- automotivePredictive modeling for manufacturing of composites
- Virtual design of composites
- Leveraging new developments in composites for next
- generation vehicles

Ken Gould, E-Mobility Technical Systems Engineer, Porsche Cars North America (includes focus on Spyder)

Hank Bonutti, Advanced Technology Manager, Mahindra North American Technology Center

Oliver Kuttner, CEO And Founder, Lightweighting Engineer, Edison2

- Dan Panoz, Founder and President, Panoz
- 12:30 Questions and Discussion
- 12:40 Networking Lunch In Exhibition Area

Exploiting Digitalization & Industry 4.0 For Manufacturing With Advanced Lightweight Materials

13:50 Update On New Initiatives Of Clemson's Center For Advanced Manufacturing

Dr. Mark Johnson, Founding Director, Clemson University Center for Advanced Manufacturing (CU-CAM)

14:05 Questions and Discussion

PANEL - DIGITALIZATION IN MANUFACTURING PROCESSES

14:15 Exploiting Digitalization Of Automotive Manufacturing Under Industry 4.0 For Smarter Faster Production And Improved Profit Margins

- Potential for new software and collaborative IT to enhance product design and transform traditional production and supply chain inefficiencies
- Achieving more agile manufacturing leveraging artificial intelligence (Al), advanced analytics, sensors, machine learning and IoT
- Benefits in terms of faster tooling turnaround and lower capital investment

Dr. Mark Johnson, Founding Director, Clemson University Center for Advanced Manufacturing (CU-CAM)

Antonio Mercado, Advanced Manufacturing Engineer, Manager Body, Karma Automotive

Prof. Dr.-Ing. Sama Mbang, Leader, European Affordable Lightweight Automobiles Alliance Project, **Daimler Mercedes-Benz** **Dr. Ing. Fouad el Khaldi**, Strategy & Innovation General Manager, **ESI Group**

Dr. Glenn Daehn, Mars G. Fontana Professor of Metallurgical Engineering, Department of Materials Science and Engineering, The Ohio State University (OSU)

Dr. Andrzej Nycz, Manufacturing Technical Lead, Manufacturing Demonstration Facility (MDF), Wire-Arc Metal Additive, Oak Ridge National Lab. (ORNL)

15:05 Networking Coffee Break In The Exhibition Area

15:35 Joining New High Strength Steels And Aluminum Alloys

Dr. Glenn Daehn, Mars G. Fontana Professor of Metallurgical Engineering, Department of Materials Science and Engineering, The Ohio State University (OSU)

16:05 Questions and Discussion

16:15 Manufacturing Process Innovation Through Additive At Large Scale With Metals

- Where can additive manufacturing / 3D printing support high volume applications now and in the future?
- Scaling up additive and 3D manufacturing for metals
- At what volume are you better off just making a tool?
- Case studies on potentially transformative applications

Dr. Andrzej Nycz, Manufacturing Technical Lead, Manufacturing Demonstration Facility (MDF), Wire-Arc Metal Additive, **Oak Ridge National**

۲

Lab. (ORNL)

16:50 Questions and Discussion

17:00 Chair's Closing Remarks - Followed by Amazon Echo and Champagne Draw

17:10 End Of Conference



Research Engineer, Jaguar Land Rover

www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com



ADVANCED LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE MANUFACTURING & JOINING INNOVATION SOUTHERN STATES 2019: A GALM SERIES EVENT



۲

SPEAKER INTERVIEW

۲

Dr. Ing. Fouad el Khaldi

Strategy & Innovation General Manager **ESI Group**

Dr el Khaldi, can you let us know a bit more about your background and current activities?

I work for world-leading simulation software provider ESI Group. I have played a major role in establishing and then growing their Virtual Manufacturing solutions, supporting industrial manufacturers in reaching greater process efficiency through digital transformation. Today, our simulation solutions span most manufacturing processes, from casting to sheet metal forming, welding and assembly, joining, composites manufacturing and metal additive manufacturing. Our expertise in the physics of materials is at the foundation of these solutions and what makes them able to deliver real results, virtually. I currently oversee ESI's Industry Strategy and Innovation portfolio, developing an ideal ecosystem to foster innovation and develop tomorrow's leading digital solutions.

Why is the digital twin a critical part of manufacturing 4.0 transformation?

Today, manufacturing process design, process validation, and actual production are well optimized but remain disconnected. Thanks to recent developments (Big Data, Internet of Things, Artificial Intelligence...), these three phases can finally connect! Engineers can benefit from faster iteration loops and better assess the impact of process design decisions. Data from real life performance offers opportunities for continuous learning, which will benefit the next generation of products by upgrading design assumptions. This becomes key as we speak increasingly of predictive maintenance and managing a product's performance throughout its lifetime (Product Performance LifecycleTM or PPL), rather than delivering a product that performs on day one (what conventional Product Lifecycle Management or PLM covers).

and context, and to detect early signals of deviation. A Hybrid Twin[™] enables asset managers to get the information necessary to assess cause & effect relationships, and to implement the appropriate corrective measures.

Why hybrid? This is crucial in overcoming the limitations of a digital twin: indeed, if we limit ourselves to data collected from historical and real-life operations, we can only predict behaviors that already took place. Whereas building on a virtual prototype that reproduces the asset as-good-as-real (capturing for instance its material characteristics after manufacturing and assembly) helps us predict almost any kind of future incident with precision, even in the case of changing parameters (materials variations, operating conditions, etc.).

How will simulation and modeling evolve to support optimization of manufacturing processes including forming, welding, additive manufacturing, and assembly?

Modern manufacturers rely on simulation and pilot tests to ensure that they're meeting various time, quality, cost requirements in their manufacturing process design and validation. However, they typically limit the use of simulation to the methods and the validation engineering departments and haven't deployed it into production for various reasons – mainly related to complexity and response time.

Good news for production managers, ESI's innovative Parametric Reduced Model technology enables the development of a Hybrid Twin™ with real time responses, derived from a predictive detailed 3D model built in the process design and validation phase (see above graphic). The Hybrid Twin™ opens new opportunities to augment the PLC (Programmable Logic Controller) capacity for smarter machine control. The Hybrid Twin™ will be loaded on site as edge computing (small processors next to the machine) for obvious performance and security, benefiting from recent IoT advances, such as 5G. Factory production managers will be able to measure



and predict production performance more efficiently, to detect early signs of deviation and to anticipate troubleshooting, thus maintaining the required quality (reducing scraps) and ensuring optimal performance.

Early pilot projects are already demonstrating the feasibility of such a solution and showing manufacturers how the simulation capabilities will be adapted and streamlined to be implemented right at the heart of the factories – with very encouraging outcomes.

What role do you see for digital twins in Smart Factories?

Virtual Prototyping is a powerful methodology enabling the design and validation of manufacturing processes. It's at the core of ESI's Hybrid Twin[™] approach, where we combine the virtual prototype with the data coming from industrial plants to measure the real operational performance, to adjust the initial model to real life data

What are you looking forward to at the new Atlanta conference?

I will discuss with our customers and partners regarding their recent challenges and look for innovation trends - also eager to meet new people in order to extend our ecosystem of industrial, technological and academic partners. See you there!

www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com

INTRODUCING DUR GENERATION 3 ADVANCED HIGH-STRENGTH STEEL

۲



Roof Hea<mark>der:</mark> 980 XG3[™] Steel 10% weight savings

A Pillar (Outer/Inner): 980 XG3[™] Steel Secondary mass savings

۲

Rear Rails: 980 XG3[™] Steel 20% weight savings

Longitudinal Members: 980 XG3[™] Steel 10% weight savings B Pillar (Outer/Inner): 980 XG3[™] Steel 20% weight savings

Hinge Pillars: 980 XG3[™]Steel 15% weight savings

BUILD LIGHTER AND SAFER VEHICLES

USS

United States Steel Corporation

Automotive Solutions

USSTEELXG3.COM

XG3@USS.COM

(877) 887-6989



ADVANCED LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE MANUFACTURING & JOINING INNOVATION SOUTHERN STATES 2019 : A GALM SERIES EVENT

 $(\blacklozenge$

SPEAKER LINE-UP:



Elie Tohme Director, Body Engineering Karma Automotive



Hank Bonutti Advanced Technology Manager Mahindra North American Technical Center



۲

Dr. Hesham Ezzat Program Manager American Iron and Steel Institute (AISI)





Prof. Dr.-Ing. Sama Mbang Leader, European Affordable Lightweight Automobiles Alliance Project Mercedes-Benz (Daimler AG)

Dr. Andrzej Nycz Technical Lead, Manufacturing Demonstration Facility, Wire-Arc Metal Additive Oak Ridge National Laboratory (ORNL)



Michael Davenport Director of Applications Engineering United States Steel



Dr. Ing. Fouad el Khaldi Strategy & Innovation General Manager ESI Group



Dr. Mark Johnson Founding Director Clemson Center for Advanced Manufacturing



Manufacturing

Dan Panoz

Panoz, LLC

Founder and President

Oliver Kuttner Lightweighting Engineer, CEO Edison2

Senior Applications Engineer

Boris Baeumler

DEPRAG



Jeff Koehler Senior Business Development Manager, ADAS / Safety / Chassis Henkel Corp.

www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com

۲



ADVANCED LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE MANUFACTURING & JOINING INNOVATION SOUTHERN STATES 2019: A GALM SERIES EVENT

Bashar Kirma

Henkel Corp.

Chris Russell

Sales Manager

Henkel Corp.

Powertrain & eMobility



Brooke Virost Sales Engineer Henkel Corp.



Mark Whaley Technical Manager, Structural Inserts Henkel Corp.



Kenneth Gould E-Mobility Technical Systems Engineer Porsche Cars North America



Dr. Srikanth Pilla Jenkins Endowed Professor, CU-ICAR and Founding Director Clemson Composites Center

Senior Business Development Manager,



Prof. Yang Yuansheng lead researcher, magnesium engineering China Institute of Metal Research Chinese Academy of Sciences



Dr. Glenn Daehn Mars G. Fontana Professor of Metallurgical Engineering, Department of Materials Science and Engineering The Ohio State University (OSU)



Antonio Mercado Advanced Manufacturing Engineer, Manager Body Karma Automotive

Overall a very knowledge filled and well produced conference. Presenters were well selected and well prepared

Engineering Group Manager, General Motors

www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com



۲

SMART VIRTUAL PROTOTYPING

Deeper data analytics. Animated systems. Virtual sensors for intelligent products. A fully immersive experience.

As a leading innovator in Virtual Prototyping, ESI brings your innovations to life through a realistic virtual experience of your product, as manufactured. This helps engineers secure a reliable solution in the virtual world, and save time in the real one.

www.esi-group.com/smart

ESI software and services enable your digital transformation

aht © ESI Gro

۲



ADAPTIVE DFS The game changer for the lightweighting industry.

In addition to an EC-Servo screwdriver, this revolutionary patented tool uses EC-Servo technology for linear movement and to generate the substantial downforces needed. Unlike widely used pneumatic cylinders with proportional valves, ADAPTIVE DFS is capable of instantaneously changing force, which is essential for flow fastener assembly. Its compact and modular unibody design as well as the closed loop control system unlock our unique adaptive capability, making this a true engineering marvel. A cylinder is no match! Its unique capability is now officially declared **UNTOUCHABLE!**

Find out more at depragusa.com • 800.4.DEPRAG





Lightweighting with Aluminum Extrusions

Making cars lighter, safer and recyclable

Hydro is a major global supplier of extruded aluminum profiles, semi-finished components, system solutions and finished products - all depending on the customer's requirements.

 $(\blacklozenge$

Components and systems include:

- Body in white structual components for improved performance and safety.
- E-mobility solutions including battery frames, cold plates and motor housings.
- Power train engine parts with superior machinability and mechanical properties.
- Interior parts including seat tracks, seating components and trim.
- Chassis related products including subframes, suspension and cross members.





۲

Better Bigger Greener

Hydro Profile Academy Learn about aluminum for automotive design at a Hydro's Profile Academy, a two-day educational course on designing with aluminum.

www.aluminumeducation.com

Hydro Extrusion North America NorthAmerica.Sales@hydro.com (877) 710-7272

www.hydro.com

Atlanta, Georgia October, 2019

۲

Galaxy Trade and Technology is proud to present: "Magnesium: Advanced Lightweight Applications for Automotive Manufacturing"

 $(\blacklozenge$



Galaxy: a China-US joint venture, focused on international magnesium science, trade and production Seminar: scientific studies from China about advanced magnesium alloys Presenter: researcher from national academic institute specializing in magnesium alloys

Format: technical report followed by a question-and-answer session
 Purpose: the performance and cost considerations of
 using magnesiun in current and next-generation vehicles
 Cooperation: China's scientists are committed to sharing insights
 and solutions with their international colleagues

www.galaxytradetechnology.com Michael North: 01-323-422-9602



www.automotive-lightweight-materials-manufacturing-south.com +44 (0)800 098 8489 info@lbcg.com



Developing Affordable Mass Market Battery Electric Vehicles
Battery Electric Vehicle Architectures

۲

January 29-30 | Troy, MI www.urlcomingsoon.com



 GTH ANNUAL

 Lightweight Materials Joining, Forming

 & MANUFACTURING INNOVATION 2019

 A GALM SERIES EVENT

Detroit Congress

February 19-20 | Troy, MI www.global-lightweight-vehicle-manufacturing.com



April 28-29 | Atlanta, GA www.automotive-paintshop-innovation-congress.com



April 29-30 | Munich, Germany www.global-automotive-lightweight-materials-europe.com



May 20-21 | Munich, Germany www.beva-europe.com

Developing Affordable Mass Market Battery Electric Vehicles Battery Electric Vehicle Architectures

Congress 2020

June 24-25 | San Jose, CA www.beva-usa.com

Bth Annual GLOBAL AUTOMOTIVE LIGHTWEIGHT MATERIALS SUMMIT NORTH AMERICA 2020

August 25-27 | Detroit, MI www.global-automotive-lightweight-materials-detroit.com

> ADVANCED LIGHTWEIGHT MATERIALS FOR AUTOMOTIVE MANUFACTURING & JOINING INNOVATION Southern states 2020; a galm series event

October 28-29 | Atlanta, GA www.automotive-lightweight-materials-manufacturing-south.com

۲

UPCOMING