

## SIP 1

### GLOBAL AUTOMOTIVE CHANGE: THE MOVE TO THE ECO-CAR

Program Organizers:

Ian Donaldson, GKN Sinter Metals  
Mark Foster, Allied Sinterings, Inc.  
John E. Smugeresky, Sandia National Laboratories

The trend in the global automotive sector for the Eco-Car, towards significantly reduced energy consumption and pollution, will drive new technology directions and opportunities that will have an impact on the powder metallurgy market. Near-term actions include the downsizing and boosting of engines (e.g., direct injection, advanced turbochargers), down-speeding engines, weight reductions, and fuel-saving six- and seven-speed transmissions, aerodynamics, and mild hybrids. Vehicle electrification will continue leading to increased use of mechatronics and a transformation away from the dependence on the internal combustion engine towards more sophisticated power plants.

These changes will provide major challenges for the PM industry leading to technological breakthroughs for new alloys and compounds, innovative processing techniques plus new structural and electrical energy components. This SIP will focus on current PM technologies state of the art, trends in powder material opportunities, and what technologies have the most promise for impacting the changes needed to enable the Eco-Car!

Presentations in Part 1 will run 45 minutes each, including questions. Presentations in Part 2 will run 30 minutes each, including questions. Manuscripts that are submitted will be published in the conference proceedings.

#### PART 1

##### Monday morning

9:45–11:15 a.m. (09:45–11:15)

##### Session Chairman:

Mark Foster  
Allied Sinterings, Inc.

0050 U.S.A.

##### Powder Metallurgy—A Green Process for Automotive Parts

Eric Boreczky, Kalathur S. Narasimhan, FAPMI, Hoeganaes Corporation

0153 U.S.A.

##### Powder Metal Usage in Hybrid Vehicles

K. S. Narasimhan, FAPMI, Eric Boreczky, Timothy J. Hale, Hoeganaes Corporation

#### PART 2

##### Monday afternoon

3:00–4:30 p.m. (15:00–16:30)

##### Session Chairman:

Ian Donaldson  
GKN Sinter Metals

0042 Canada

##### Recent Advances in the Development of “Press-and-Sinter” Aluminum PM Alloys for the Production of Lightweight Automotive Components

Paul Bishop, Dalhousie University

0003 U.S.A.

##### Energy-Efficient Press-and-Sinter of Titanium Powder for Low-Cost Components in Vehicle Applications

Thomas M. Zwitter, Webster-Hoff Corp. & Philip Nash, Illinois Institute of Technology

0088 U.S.A. & China

##### Comparison Study of Powder Metallurgy Ti Metal Powder and TiH<sub>2</sub> Powder

Hongtao Wang, Zhigang Z. Fang, Michael Lefler, Pei Sun, University of Utah, Colin McCracken, Dan Barbis, Reading Alloys, Inc. an Ametek Company & Weiping Tian, Hao Li, Yunnan Metallurgical Group Co.

## SIP 2

### ADVANCES IN TOOLING TO MEET TODAY'S DEMANDING PM APPLICATIONS

Program Organizers:

Scott Davis, PMG  
William R. Gasbarre, Gasbarre Products, Inc.

Eric J. Reinert, Bronson & Bratton, Inc.

With the increased demand for complex part configurations, cost-effective tooling, decreased lead-times, extended tool life, and higher-tonnage applications, several advances have been made

regarding compaction tooling. Best practices in tool design, tool material selection, and tool surface coatings will be presented.

Individual presentations in Part 1 will run approximately 35 minutes with an additional 20-minute question-and-answer period following the presentations. Individual presentations for Part 2 will run 30 minutes each, including questions. Manuscripts that are submitted will be published in the conference proceedings.

#### PART 1: TOOL DESIGN

##### Monday morning

9:45–11:15 a.m. (09:45–11:15)

##### Session Chairman:

Scott Davis  
PMG

0168 U.S.A.

##### Compacting Tool Design for Today and Tomorrow

Robert T. Beigel, JIT Tool & Die, Inc.

0169 U.S.A.

##### Impact of Solid Modeling on PM Tool Design

Stephen Greene, Bronson & Bratton, Inc.

#### PART 2: TOOL MATERIALS/ COATINGS

##### Monday afternoon

3:00–4:30 p.m. (15:00–16:30)

##### Session Chairman:

Eric J. Reinert  
Bronson & Bratton, Inc.

0170 U.S.A.

##### Carbide Grades for PM Tooling

Leonid I. Frayman, General Carbide Corporation

0171 U.S.A.

##### Tool Steel Selection for PM Tooling

Robert E. (Bud) Carnes, Carpenter Technology

0172 U.S.A.

##### Coating Technology for PM Tooling

Robert Jacoby, Metalife Industries, Inc.

## SIP 3

### ADVANCES IN NANOPARTICLE SCIENCE & TECHNOLOGY

Program Organizers:

Thomas Jewett, Global Tungsten & Powder Corporation

John L. Johnson, ATI Engineered Products

Alan Lawley, FAPMI, Drexel University  
Richard Ricchi, General Motors Corporation

Nanosized-particle and nanostructured materials are finding increasing utility and application as a result of their unique properties. This SIP embraces a diverse spectrum of metallic and nonmetallic nanomaterials, focusing on characterization, processing, and attendant microstructures. Physical and mechanical properties are addressed and the status of scale-up and commercialization of nanomaterials is discussed in relation to wear and corrosion-resistant applications, abrasives, microelectronics, energy conversion, chromatography, and biomaterials.

Individual presentation times will run 30 minutes, including questions. Manuscripts are encouraged and those submitted will be included in the conference proceedings.

#### PART 1: CHARACTERIZATION & PROCESSING

##### Monday morning

9:45–11:15 a.m. (09:45–11:15)

##### Session Chairman:

Thomas Jewett  
Global Tungsten & Powders Corporation

0135 *United Kingdom*

#### WC Powder Characterization through an International Inter-laboratory Comparison Exercise

Bryan Roebuck, Kenneth P. Mingard, National Physical Laboratory

0063 *Korea*

#### Microstructural Development during Nanopowder Agglomerate Sintering for PM Microcomponents

Jai-Sung Lee, Woo-Kyung, Berm-Ha Cha, Jun-Chul Yoon, Hanyang University

0136 *U.S.A.*

#### Microstructure Retention and the Reality of Grain Coarsening during Sintering

Randall M. German, FAPMI, San Diego State University

#### PART 2: NANOPARTICLE FABRICATION & APPLICATIONS

##### Monday afternoon

3:00–4:30 p.m. (15:00–16:30)

##### Session Chairman:

Alan Lawley, FAPMI  
Drexel University

0142 *U.S.A.*

#### Diamond Nanoparticles

Yury Gogotsi, Vadym Mochalin, Drexel University

0134 *U.S.A.*

#### Synthesis and Applications of Highly Dispersed Uniform Metallic Nanoparticles

Dan V. Goia, I. Halaciuga, K. Balantrapu, Clarkson University, Center for Advanced Materials Processing

0068 *Canada & U.S.A.*

#### Nanostructured Aluminum for Structural and Coating Applications

George E. Kim, Perpetual Technologies, Tony Addona, n-WERKZ, Inc., Angela L. Moran, U.S. Naval Academy, Kenneth Scandell, NAVSEA & Matthew Trexler, Victor K. Champagne, U.S. Army Research Laboratory

#### PART 3: NANOSTRUCTURED COATINGS

##### Tuesday morning

8:00–9:30 a.m. (08:00–09:30)

##### Session Chairman:

John L. Johnson  
ATI Engineered Products

0132 *U.S.A.*

#### Bulk-Materials Nanotechnology

Daniel J. Branagan, The NanoSteel Company

0139 *U.S.A.*

#### Commercial Implementation of Tailored Nanocrystalline Metal-Alloy Coatings

Alan C. Lund, Xtalic Corporation & Christopher A. Schuh, Massachusetts Institute of Technology

0047 *South Africa*

#### Electrophoretic Deposition of Nanoscale PGM Alloys

Deborah C. Blaine, Stellenbosch University & Alexander Ilchev, Leslie Petrik, Patrick Ndungu, University of the Western Cape

## SIP 4

### RAPID MANUFACTURING AND DIRECT MANUFACTURING OF METAL PARTS

Program Organizers:

Robert Dowding, U.S. Army Research Laboratory

James W. Sears, South Dakota School of Mines & Technology

Joseph Tunick Strauss, HJE Company, Inc.

One of the driving forces of rapid manufacturing (RM) is to be able to produce functional parts. Rapid-prototyping methods have enabled the “mass customization” of parts from a geometric perspective. Rapid manufacturing using metal powders is now being applied to provide the geometric attributes of custom parts combined with the properties only achievable with metallic materials. This program includes discussion of RM processes, materials, and applications.

Individual presentation times will run 30 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

#### PART 1: BIOMEDICAL APPLICATIONS OF RM

##### Tuesday morning

8:00–9:30 a.m. (08:00–09:30)

##### Session Chairman:

Robert Dowding  
U.S. Army Research Laboratory

0073 *Finland*  
**Direct Metal Laser Sintering in Manufacturing of Biomedical Parts**  
 Juha Kotila, Olli Nyrhilä, Maria Latikka, Tatu Syvanen, Lena Thorsson, EOS Finland

0109 *U.S.A.*  
**Additive PM Manufacturing of Precious Metal**  
 Howard A. Kuhn, ProMetal, a Division of Exone Corporation

0163 *United Kingdom*  
**Selective Laser Melting—A New Approach to Metal-Parts Manufacture**  
 Chris Sutcliffe, MTT Technologies Group

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**PART 2: ADVANCED RM PROCESSES**  
**Tuesday morning**  
 10:45 a.m.–12:15 p.m. (10:45–12:15)

**Session Chairman:**  
 Joseph Tunick Strauss  
 HJE Company, Inc.

0023 *Sweden*  
**Additive Manufacturing of Titanium Aluminide Parts by Electron Beam Melting**  
 Ulf R. Ackelid, Arcam AB

0161 *U.S.A.*  
**Advanced Rapid Manufacturing of IBR by Direct Metal Deposition**  
 J. Choi, POM Group, Inc.

0160 *U.S.A.*  
**Use of Rapid-Manufacturing Techniques to Produce Novel Microstructures in Ti-Based Systems**  
 Peter C. Collins, Quad Cities Manufacturing Laboratory, John M. Sosa, Hamish L. Fraser, Ohio State University & James W. Sears, South Dakota School of Mines & Technology

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**PART 3: RM METHODS & APPLICATIONS**  
**Tuesday afternoon**  
 3:30–5:00 p.m. (15:30–17:00)

**Session Chairman:**  
 James W. Sears  
 South Dakota School of Mines & Technology

0166 *U.S.A.*  
**Cold Spray as a Rapid Manufacturing Technology**  
 Vic Champagne & Matthew Trexler, U.S. Army Research Lab

0164 *U.S.A.*  
**Additive Manufacturing of Architectural and Art Forms by 3D Printing**  
 Howard A. Kuhn, The Ex One Company LLC

0165 *U.S.A. & United Kingdom*  
**Gas-Atomised Powders Designed for Rapid Manufacturing**  
 Torbjorn Tingskog, Martin A. Kearns, Sandvik Osprey Ltd.

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## SIP 5

### THE CHARACTERIZATION AND TESTING OF METAL POWDERS AND PM PRODUCTS

**Program Organizers:**  
 W. Brian James, FAPMI, Hoeganaes Corporation  
 Thomas F. Murphy, FAPMI, Hoeganaes Corporation  
 Sherri R. Bingert, Los Alamos National Laboratory

This program will review the testing and characterization of both metal powders and PM products. Standardized tests will be covered along with an indication of new tests that are in the process of being standardized. Metallographic tests (light optical as well as SEM) for metal powders and premix additives will be covered as well as tests that may be used to evaluate the surface of metal powders and the parts made from metal powders. An indication of how microstructure evolves in ferrous PM materials will be provided along with the use of various techniques to characterize and track microstructural development.

The characterization of PM parts via non-destructive evaluation will be highlighted as well as approaches that may be used to characterize the machinability of PM materials. The program will conclude with a review of techniques for evaluating failures in PM parts.

Individual presentation times will run 45 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

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**PART 1**  
**Tuesday morning**  
 8:00–9:30 a.m. (08:00–09:30)

**Session Chairman:**  
 W. Brian James, FAPMI  
 Hoeganaes Corporation

0145 *U.S.A.*  
**Standardized Tests for Metal Powders and PM Parts**  
 W. Brian James, FAPMI, Hoeganaes Corporation

0146 *U.S.A.*  
**Metallographic Analysis of Powder Characteristics**  
 Thomas F. Murphy, FAPMI, Hoeganaes Corporation

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**PART 2**  
**Tuesday morning**  
 10:45 a.m.–12:15 p.m. (10:45–12:15)

**Session Chairman:**  
 Thomas F. Murphy, FAPMI  
 Hoeganaes Corporation

0150 *Sweden*  
**Surface Characterization of Metal Powders and PM Parts**  
 Lars Nyborg, Chalmers University of Technology

0147 *Canada*  
**The Evolution of Microstructure in Ferrous PM Materials**  
 Carl Blais, Laval University

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**PART 3**  
**Tuesday afternoon**  
 3:30–5:00 p.m. (15:30–17:00)

**Session Chairman:**  
 Sherri R. Bingert  
 Los Alamos National Laboratory

0151 *U.S.A.*  
**High Energy X-ray Diffraction Microscopy: Probing Microstructure Response at the Single Grain Scale**  
 Robert M. Suter, Carnegie Mellon University

0080 *U.S.A.*  
**Overview of Different NDT Processes for Powder Metallurgy**  
 Ian Donaldson, GKN Sinter Metals

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## PART 4

### Wednesday morning

8:00–9:30 a.m. (08:00–09:30)

#### Session Chairman:

W. Brian James, FAPMI  
Hoeganaes Corporation

0148 U.S.A.

#### Concepts and Methods for Characterizing and Evaluating Machinability

John Engquist, Burgess-Norton Mfg. Co.

0149 U.S.A.

#### PM Failure Analysis

Thomas F. Murphy, FAPMI, Hoeganaes Corporation

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## SIP 6

### MACHINABILITY OF PM COMPONENTS: MATERIALS, PROCESSES, AND BEYOND

Program Organizers:

Carl Blais, Laval University  
Roger Lawcock, Gates Canada, Inc.  
David Milligan, North American Höganäs, Inc.

The amount of secondary machining performed on powder metallurgy (PM) components continues to increase. PM components are becoming more complex and PM manufacturers are responding by using machining to increase value. PM materials provide a challenge to traditional machining operations with features, such as porosity, that can result in PM being more difficult to machine than wrought materials. In order for PM to continue to be an economical alternative to traditional manufacturing techniques, machining of PM components needs to be continuously improved.

This program will discuss various aspects of improving and evaluating the machinability of PM components. The presentations will discuss the latest developments in additives to improve the machinability of PM components, aspects of machining PM, and different machining techniques such as grinding and hard turning.

Individual presentation times will run 30 minutes, including questions. Manuscripts that are submitted will be published in the conference proceedings.

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## PART 1: ENHANCING ADDITIVES I

### Tuesday afternoon

3:30–5:00 p.m. (15:30–17:00)

#### Session Chairman:

David Milligan  
North American Höganäs, Inc.

0103 U.S.A.

#### Machinability Improvements to Ferrous PM Steels

Bruce A. Lindsley, Hoeganaes Corporation

0154 Canada

#### Effect of Machining Enhancer Additions on Static and Dynamic Properties of PM Materials

Francois Chagnon, Rio Tinto Metal Powders

0055 U.S.A.

#### The Use of a New Machinability Enhancer to Decrease the Effect of Processing Conditions on the Machinability of Ferrous Powder Metallurgy Components

Roland T. Warzel III, Bo Hu, Ian Howe, North American Höganäs, Inc. & Suresh Shah, Jerry Falleur, Cloyes Gear & Products Inc.

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## PART 2: ENHANCING ADDITIVES II

### Wednesday morning

8:00–9:30 a.m. (08:00–09:30)

#### Session Chairman:

Carl Blais  
Laval University  
Canada

0097 U.S.A., United Kingdom & Canada

#### Machinability Characterization of Novel Mixes Containing Hard Particles

Denis Christopherson, Jeremy Koth, Vicki Urban, Federal-Mogul Corporation, Les Farthing, Federal-Mogul Sintered Products Ltd. & Philippe Beaulieu, Gilles L'Espérance, École Polytechnique de Montréal

0155 U.S.A.

#### Optimizing Machining Additives for Different Materials and Machining Operations

Bo Hu, North American Höganäs, Inc.

0092 Japan

#### Effect of Composite Oxide JFM4 on the Machinability of Iron Based Sintered Steel

Yukiko Ozaki, Takanori Sato, Tomoshige Ono, Shigeru Unami, JFE Steel Corporation

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## PART 3: CHARACTERIZATION Wednesday morning

9:45–11:15 a.m. (09:45–11:15)

#### Session Chairman:

Roger Lawcock  
Gates Canada, Inc.  
Canada

0156 U.S.A.

#### Machinability-Test Methods and Standards for PM Materials

W. Brian James, Hoeganaes Corporation

0126 Germany

#### Trends in Machining of Gears

Philipp Kauffmann, Christop Gorgels, Fritz Klocke, WZL-RWTH Aachen

0159 U.S.A.

#### Methods and Tools for Evaluating and Quantifying Machinability of PM Parts

John Engquist, Burgess-Norton Mfg. Co.

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## PART 4: CHALLENGES

### Wednesday morning

11:30 a.m.–1:00 p.m. (11:30–13:00)

#### Session Chairman:

Denis Christopherson, PMT  
Federal-Mogul Sintered Products

0157 U.S.A.

#### Super Abrasive Machining and its Inherent Upstream Cost Reduction

Rocco Petrilli, Prima Business Specialists LLC

0158 U.S.A.

#### Machining of Powder Metal Components with PCBN Inserts

Brett A. Young, Shape-Master Tool Co.

0044 South Africa

#### High Performance Machining of PM Titanium

Deborah C. Blaine, Stellenbosch University