Worcester Polytechnic Institute - WPI
WPI: from research to innovation to impact

Robert Goddard, Innovator  
First liquid-fueled rocket  
Class of 1908

Robert Harvey, Innovator  
Early artificial heart  
Class of 1970

Michael Dolan, Leader  
ExxonMobil Chemical  
Class of 1975

Kathy Loftus, Leader  
Whole Foods Market  
Class of 1986

Elwood Haynes, Innovator  
Stainless steel  
Class of 1881

Carl Clark, Innovator  
Auto airbag system  
Class of 1945

Dean Kamen, Innovator  
Segway  
Class of 1973

Edward Cheung, Innovator  
Hubble Space Telescope  
Class of 1985
US News & World Report ranks WPI...

In top 25% of national research universities

Among “Best Undergraduate Engineering Programs”
An industry-university alliance with 90 corporate partners dedicated to advance the frontiers of net shape manufacturing through knowledge creation and dissemination, and through education.
MPI: Industry-University Alliance in Action

- Consortium Member Companies
- Director at Large
- Steering Committee
- Consortium Director
- Focus Groups
- Research Projects
- Research Staff
MPI Mission

To be the premiere industry-university alliance serving the metal processing industry by serving consortium members’ needs, by establishing the needed knowledge base, and by educating future leaders of the industry.
MPI Vision

- Member driven
- Multidisciplinary in scope
- Virtual enterprise in framework
- Cost effective
  pooling resources/leveraging
- University research
  fundamentals with deliverables
- Workforce /students/interns
MPI Inter-disciplinary Approach

- Materials Engineering
- Mechanical Engineering
- Electrical Engineering
- Chemical Engineering
- Management/Marketing
- Other Universities
- Government Laboratories
BUT...
Context / applications are well defined

BY WHOM ?...
The marketplace - the industry
Research Programs

- **Pre-competitive** fundamental research funded by the members
- **Large-scale** projects funded by the federal government or foundations leveraging the research agenda of the centers
- Specific and **proprietary research** conducted for the consortium members
Fundamental Studies (Pre-Competitive)

Characterization of Alloy Castability – Hot Tearing
*S. Li and D. Apelian*

Characterization of Alloy Castability – Fluidity
*B. Dewhirst and D. Apelian*

Microstructure Evolution during Friction Stir Processing of Aluminum Casting Alloys
*N. Sun and D. Apelian*

Improving Aluminum Casting Alloy and Process Competitiveness
*Mandal and M.M. Makhlouf*
Fundamental Studies (Pre-Competitive)

- Evaluation of Distortion and Residual Stresses During Heat Treatment of Aluminum Alloys
  
  *L. Wu and M.M. Makhlouf*

- Controlled Diffusion Solidification – Fundamentals and Mechanisms
  
  *K. Symeonidis, D. Apelian, and M.M. Makhlouf*

- Casting Aluminum Alloys in Helium
  
  *M.Q. Saleem, and M.M. Makhlouf*

- Aluminum Nano-Composites for Elevated Temperature Applications
  
  *C. Bogonovo, H. Yu, and D. Apelian*
ACRC RESEARCH PORTFOLIO

Leveraged Projects – Large Scale

- Innovative Semi-Solid Metal Processing
  D. Apelian, Q. Xu and M.M. Makhlof
  (funded by DOE)

- High Integrity Magnesium Auto Castings
  J. Keist, Y. Li, and D. Apelian
  (funded by US CAR)

- Aluminum Die Casting Alloy Studies
  High Performance Die Casting Alloys
  L. Wang, D. Apelian, and M.M. Makhlof
  (funded by DLA)
MPI is an industry-university alliance dedicated to advancing the state of the art in the metal processing industry. Through its focus on metal processing, MPI brings fundamental understanding to existing processes, develops new methods, and addresses management-technology interface issues with input from its industrial partners. Though the work is fundamental in nature, the context of the work has well-identified commercial applications. MPI's research is strengthened by the cooperative, interjunctural program & efforts.

www.wpi.edu/+mpi
SUMMER 2010

Forging ahead with a new paradigm for funding, more members, and the launch of a new center

Diran Apelian shares strategies for success after two difficult years.

Carol Garofoli welcomes new members and lauds student accomplishments.

ACRC

Dave Weiss on productive work completed and under way, including research on affordable bulk processing techniques

2010 ACRC Awards presented June 1: The Ray H. Witt Award to Mr. Daniel Twarog and Merton C. Flemings Award to Dr. Kevin Anderson

ACRC Student Research and Projects
Optimization of the Convection Heat Transfer Coefficient in the Stator-rotor Air Gap of an Electric Motor

Processing Routes for Aluminum-based Nano-composites

Metal Matrix Nano-composites for Elevated Temperature Applications

CHTE

Members in the News
Surface Combustion, Inc.
WTe Corporation

People in the News
Diran Apelian
Brian Dewhirst
Reinhold Ludwig
Rick Sisson
Inductees to Alpha Sigma Mu

Kudos
Diran Apelian
Brad Lynch
Muhammad Q. Saleem
Yancy Riddle

Congratulations to our recent graduates:
Cecilia Borgonovo, MS in Material Science and Engineering; Shimin Li, PhD in Material Science and Engineering; Brad Lynch, BS in Mechanical Engineering; and Hao Yu, MS in Material Science and Engineering

Accounting update
CR3—68 percent of members have paid as of July 1. To receive a new invoice or resolve issues, contact Renee Brodeur.

ACRC and CHTE—FY11 invoices were sent the week of June 21. Payment by August 1 is appreciated. Thank you to all
MAJOR IMPACT

- COMMERCIALIZATION OF IDEAS
- INNOVATION
- COMPETITIVENESS OF OUR INDUSTRIAL MEMBERS
- “Theory and Practice” ... Practiced!

“In theory, there is no difference between theory and practice. In practice, there is.”

Yogi Berra
SUMMER SCHOOL 2011

Casting of Light Alloys and Composites: from innovative design, processes, and applications

Organized by: D. Apelian, WPI, USA; F. Bonollo, U of Padova, Italy; and L. Arnberg, NTNU, Norway

Venue and Dates:
July 25-29, 2011 in Vicenza, Italy
Human Resources Issue

- Undergraduate internships
- Graduate internships
- Workforce education
Undergraduate Internships: Senior Thesis Project

Costs

- Summer Labor Cost
- Supplies
- Faculty Involvement
Senior Thesis Project-Examples

Rapid Prototyping of Tools for Investment Casting
- Jay Gajewski
- Tim Doyle
- Keith Wilkinson

Annealing Furnace Design
- Alison Keach
- Joseph Tucker

Thermal Processing of Aerospace Components
- Toby O’Hara
- Ben Casper
- Brian Sadanowicz
- Kosta Karachristos

Defects in Lost Foam Casting
- Richard Anderson
- Matthew Bettez
- Bradford Denison
Graduate Internships:

**Year 1:**

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<th>June</th>
<th>January</th>
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<td>Industry</td>
<td>WPI</td>
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**Year 2:**

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<th>WPI</th>
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Patrick Hogan

Industrial Intern
SPX-Contech Division
M.S. degree 2008

Advisor: Apelian
ACRC - Benefits and Membership

**Intellectual Capital**
- Consortium members guide and select research projects
- Proprietary research projects (for member companies) at reduced cost
- Intellectual property developed is available to member companies (royalty free)
- Member-driven research programs on diverse and practical projects
- Valuable source of R&D data

**Human Capital**
- Access to faculty, students, industrial interns and future employees
- Educate young adults for future careers and leadership positions
- Provides human capital and intellect for the 21st century
- Industrial internships
ACRC - Benefits and Membership

Valuable Source of R&D Data
- Asset to the metals industry for more than 20 years
- Research Project Reports – two reports per year
- Participation and discussion through focus groups and steering committees at 2 annual meetings (June and December)
- Cost-effective – facilities and human capital are shared by other MPI centers

Meetings
- Two annual meetings (typically in June and December)
- Workshops and seminars on topical themes

Cost
- Annual dues: $15,000 per membership year (flexible payment options available)

How to Join
- Prof. Diran Apelian dapelian@wpi.edu
- website: http://www.wpi.edu/Academics/Research/MPI/
Contact Information

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