



Center for Innovative Sintered Products

March 2001

CISP

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Message from the Director

Which directions for sintered materials?

Over the past four years I have had the opportunity to visit many production and research sites involved in developing the subfields that fall under the heading of sintered materials. The bulk of the materials currently in production are classic compositions with 50 or more years of history - steels, stainless steels, cemented carbides, alumina, aluminum, cermets, and even bronze. A hundred years ago the idea of sintering did not exist beyond the brick yard and pottery barn. So we have made much progress. The role of the university is to add fundamental understanding to these materials and processes, providing more human knowledge to allow better, faster, and lower cost production of engineered structures from these materials. But even these sintered materials have a natural life cycle and we need to keep an eye on the future. Depending on your planned retirement date, that might be a short-term vision or a long-term vision. In the spirit of looking forward, we intend to focus on the future to add vitality to the Penn State CISP program. One means to achieve this goal is to sample what is coming along, including new structures, devices, applications, properties, and processing routes. At the next CISP Member Meeting, a few CISP faculty will share their views on these new directions and we will encourage comment from the participants. As a preview, I personally feel the best direction is to differentiate sintered structures from other engineering materials, via novel materials and unique property combinations, in more complicated shapes with improved net shape manufacturing techniques, considering the ever present goal of improved dimensional precision. A few interesting examples have reached production to illustrate the concepts, but my list of opportunities is much more than can be realized in a lifetime. Come share your ideas and passions with us. It should be a curious blend of fortune telling.

Upcoming Events ...

CISP

March 15, 2001

Ferrous Powder
Metallurgy Short
Course
Ridgeway, PA

March 19-20, 2001

Understanding
Binders & Lubricants
State College, PA

March 20-21, 2001

CISP Industry
Member Meeting
State College, PA

April 12-13, 2001

PIM Tutorial Spring 2001
Atherton Hotel
State College, PA

May 4, 2001*

Sintering Concepts
Ridgeway, PA

Note: *Date Change

MPIF

March 12-13, 2001

Sinter Hardening
Seminar
Nashville, TN

March 26-28, 2001

Basic P/M Short Course
Cleveland, OH

April 3-4, 2001

P/M Sales Training
Seminar
Cincinnati, OH

April 24-25, 2001

P/M Preventive
Maintenance Seminar
Cleveland, OH

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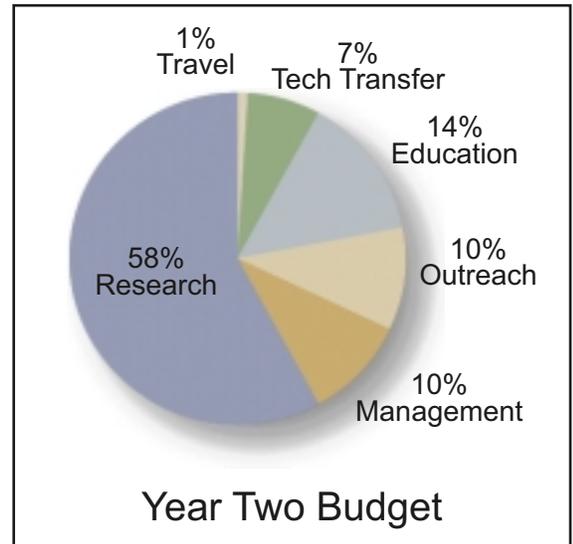
The Balancing Act



Sharon Elder
Executive Director

We are now entering the last quarter of our first year of operation. As I reflect on this past year, I take pride in what we have accomplished and am anticipating even greater endeavors to come. Maintaining the right mix between research, education, outreach and services remains a delicate feat in the balancing act. This success did not happen by accident, rather it took many years of planning, redirection and constant corrections as we strive to serve the needs of a diverse group. This past year has provided great insight as we passed from building to operating a Center of this size. Part of our challenge in building this Center is assembling a strong team of industry partners, researchers, and collaborators all focused on supplying the industry with students, service, outreach programs and research findings. Our membership has now reached over 90 members and will more than likely expand to over 100 during the next year. With our success in attracting industry members, we now find ourselves being the landmark example to emulate on campus. Due to the diverse nature of

our membership, we must continually reevaluate all facets of operations as we strive to serve effectively. At the Industry Member Meeting in March, we plan to examine year 1 research projects to determine which ones should go forward, be expanded, repackaged, or phased out. At the same time, we plan to target additional research projects that will best suit the needs of our members. We will also chart our education, outreach, and services directions for year 2. Based on input from the Pennsylvania Technology Investment Authority, we plan to increase budget allocations in the areas of education, outreach and technology transfer. An indicator of our success will be a sustained, vital, and productive program that consistently generates important results.



Industry Member Meeting

20-21 March 2001
at the
Nittany Lion Inn,
University Park, PA

- Evaluate your Website
- Predictions on Future Markets
- Directions of the Industry
- Outreach & Education Plans
- Year Two Research Agenda
- Industry Feedback

Membership Opportunities

The opportunity to become a member of the Center for Innovative Sintered Products for year 2 is now possible. We thank our current members for their input in reaching our current stage and look forward to their continued support (see list of members insert). Without their contribution this Center would not be a reality. We are now actively seeking new members to join our current members in guiding our program. The desire to involve powder suppliers, electronic and ceramic fabricators, powder metallurgy parts makers, equipment fabricators, refractories, end users, and other industry related companies remains our priority. CISP offers four levels of membership to fit the needs of companies of all sizes. This tiered membership structure allows companies to decide which level of membership they desire depending on the access to technology and decision-making levels desired (see fees/benefits insert). Current memberships can also be upgraded for additional benefits. For additional information contact: Sharon Elder (814)-865-1914, email: CISP@psu.edu

Metal Injection Molding Precision Study

The Austrian Research Center and CISP have conceptually agreed to a two-year research collaboration to benchmark and improve the precision of the MIM process. Design of experiments will be used to examine the affect of input process parameters on the dimensional precision produced by the MIM process. A generic MIM system that allows for adjustable parameters will be used. These adjustable parameters will consist of particle size distribution, particle shape, binder formulation, mixing technique, molding conditions, debinding route and cycle, and sintering technique. This study will generate a response model that can be used to predict the effect of different raw material attributes and processing methods on the final precision of a MIM geometry. For more information contact Randall M. German at rmg4@psu.edu or Donald F. Heaney at dfh100@psu.edu

St Marys Visit

Thirty-nine engineering technology students from St. Marys High School recently visited University Park. The students toured the CISP labs, the Factory for Advanced Manufacturing Educations (FAME) lab, and carved small green powder compacts for key chains, that were later sintered and sent back to them. Residing in the heart of the PM industry in Pennsylvania, many of the students were familiar with or currently have jobs in the industry. They also learned about opportunities available at Penn State as future students or as possible customers of CISP services. Due to the success of the tour, the Center plans to continue similar offerings to other high school students. For additional information contact: Susan Beyerle at 814-863-8208 or email: scb4@psu.edu

Binders and Lubricants Workshop

Improve your ability to select and use binders, lubricants, dispersants, surfactants, and solvents in the processing of metal and ceramic powders. Organized by CISP and Innovative Material Solutions, this 2-day workshop on 19-20 March at the Nittany Lion Inn, State College, PA will explore the principles and applications of organic additives used in powder consolidation. The course is designed to enable those already familiar with powder processing to understand the principles relevant to their own technology and new entrants looking for opportunities in the field. The lectures will be complemented by a 3-hour lab session involving demonstrations and one-on-one discussions. For additional information, visit the website at www.cisp.psu.edu or contact Helen Edson at (814)-863-8202 or email: hle2@psu.edu

CM Furnace to be added to the Center

A Rapid Temp Model 1512GSH2 FL from member company CM Furnaces will soon be added to the Center. This versatile furnace can both debind and sinter in the same unit. The furnace uses high purity alumina fiber insulation and pure molybdenum heating elements. Because of the hot wall construction there is no place within the furnace for the binder to condense or collect. The unit is equipped with a hydrogen-nitrogen safety system and a fully programmable power supply.

Constructed of a double stainless steel shell, the inner shell is a high purity, fibrous alumina block graded insulation package designed for a maximum continuous operating temperature of 1450°C in hydrogen. Designed for maximum temperature efficiencies and uniformity the model has an inner chamber of 13"W x 11"H x 12"D (32.5cm W x 28cm H x 30cm D).

Pictured below - Integrated Polymer Burnout and Sintering Furnace



Desktop 3D CNC Milling Machine

CISP recently added a desktop 3D CNC Milling Machine to the P/M Lab. The desktop design of the unit bridges the gap between the high speed CNC machine shop environment and the design, prototype, and engineering research environment. Given the wide range of end uses coupled with the extremely fast operations of this machine, it will allow a large number of students to utilize CNC machining at a scale appropriate for educational purposes.

This equipment will increase the number of engineering students exposed to the basic processes involved with creating 3-dimensional CAD models and operation/software used with creating parts from these models in a direct, hands-on learning environment. Significant involvement of undergraduate students via summer internships, senior theses, and independent study is planned. This opportunity to integrate design, computer programming, and engineering/fabrication activities will bridge the critical gap for the PIM and rapid prototyping industry by providing leading edge equipment not currently accessible by students at a lab-scale cost.



Pictured above - Jeremy Miller setting up the P/M lab's newest addition to rapid tooling - a high speed 3 axis CNC Milling Machine.



New Director for Outreach

CISP welcomes Ms. Susan Beyerle as the Associate Director of Outreach and Services. Originally from Columbus, Ohio, Ms. Beyerle recently assumed the duties formerly under the direction of Ron Iacocca. She received her BS from the Ohio State University in Industrial Engineering and a MS from the University of Texas at Austin in Materials Science. Her thesis research was in the area of powdered metals for electrical sliding contacts. She has worked as an engineering consultant in central Pennsylvania. Contact: 814-863-8208 or email: scb4@psu.edu

Susan Beyerle
Ass. Director of Outreach

Summer Program

CISP will be sponsoring a 10 week (June 4 – August 19 2001) summer program for undergraduate students in engineering & science fields. Our fundamental objective is to introduce undergraduate students to research and the breadth of opportunities in the science and engineering of sintering. Students will spend time working on CISP projects as well as attending seminars, discussion groups, and industry tours. Each student will receive a stipend as well as paid housing. For more information view the CISP website (www.cisp.psu.edu) or contact: Helen Edson at 814-863-8208 or email: hle2@psu.edu

Senior Capstone Design Projects

A team of undergraduate students designed an automated loading system for their senior capstone course during the Fall 2000 semester. The project, sponsored by Keystone Powdered Metal Company--a CISP member, required the students to develop, construct, and test a device that would automatically load and align a variety of powder metal components into a range of sizing presses. Although the students were challenged to have the new design run for 15 minutes without reloading, their proposed solution was able to operate 45 minutes without reloading. Projects like this one engage the students in an industrial problem, give them experience with machinery and design practice through Penn State's Learning Factory, and provide them with the opportunity to hone their communication and team skills. For more information on how a company can participate in this program, contact Renata Engel, Associate Director for Education, email: rengel@psu.edu or phone: (814-865-3164).



Team Members: Pete Hirniesen, Brian Dempsey, Shawn Britton, Kenneth Brown and Gregg Robinson.

Sponsored by: Keystone Powdered Metal Company

Upcoming Events ... continued

MPIF

May 13-17, 2001

2001 International Conference on Powder Metallurgy & Particulate Materials
New Orleans, Louisiana

June 26-27, 2001

P/M Soft & Permanent Magnetics Seminar
Indianapolis, IN

July 30-Aug 1, 2001

Basic PM Short Course
State College, PA

Sept 11-12, 2001

Advanced P/M Short Course
Indianapolis, IN

Students Corner

Pavan Suri is planning on graduating in May 2001 with a Ph.D. His area of research is the sintering of ferrous coarse powders to full density and the microstructure property links for iron-boron alloys for structural applications. His thesis is titled, "Microstructural Modification to Enhance the Mechanical Properties of Liquid Phase Sintered Iron-Boron Alloys". During the past year, Pavan has also worked with Dr. Sundar Atre on the mixing of feedstock for homogeneity effects in both metal and ceramic powders. With his intentions of working in industry, Pavan is currently scheduling interviews.



Garth Wilks is a graduate student in Materials Program in Engineering Science and Mechanics. He is expected to graduate in May 2002. His focus is non destructive evaluation and materials characterization. He is currently working under the direction of Drs. Joseph Rose and Randall German on the Ultrasonic Sensor for "In-situ" Monitoring and Control of the Sintering Process project.

Undergraduate profile

Brian Marx is a junior majoring in Materials Science. Originally from Johnstown, PA, Brian joined the P/M Lab in the summer 2000 under the one-on-one mentor program. He has remained with the Lab during the academic year and has experience in microscope analysis, metallography, and the operations of compaction presses and sintering furnaces.



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