POWDER METALLURGY ASSOCIATION OF INDIA

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PMAI Office:
B 1002 Kingston, High Street
Hiranandani Complex, Powai
Mumbai – 400076. INDIA
Tel: +91-22-2570 4588
E-mail: info@pmai.in
URL: www.pmai.in

Editorial

The International Conference on Powder Metallurgy & Particulate Materials + Exhibition and the 43rd ATM of PMAI at the Hotel Pride Plaza, Aerocity, New Delhi (20-22 Feb, 2017) offers a comprehensive technical program on all aspects of Powder Metallurgy & Particulate Materials.

Several technical presentations are included in three parallel sessions, plenary lectures and memorial lectures. A workshop on Business Opportunities in Powder Metallurgy is slated as an independent event concurrent with the Conference. The International Exhibition showcases the latest in PM technology, equipment and services from India and abroad.

The Transactions of the Powder Metallurgy Association of India, Trans. PMAI. Vol. 42 (1), 2016 has been published and is available in our website, www.pmai.in. Trans. PMAI. Vol. 42 (2), 2016 is being prepared & will be published soon.

Mr. Prakash Mohan, the recipient of Grand PMAI Student Award is narrating his experience in PM World Congress 2016 at Hamburg. A technical article by Mr. Maheswaran deals with high performance PM gears.

Other PMAI events included are the report on the annual PM Short Course PMSC-16 at VIT University, Chennai and the PMAI participation at industrial exhibitions; IMTEX-2017 at Bangalore and Auto Engineering Show 2017 at New Delhi.

Best Wishes for a Happy, Healthy and Prosperous New Year 2017 to all PMAI members.

P. Ramakrishnan

Appeal

We need news items for publication in this (thrice yearly) newsletter from PMAI members.

We mean stuff like technical developments, new products, business developments, promotions, job changes, organizational changes, mergers & acquisitions or just plain gossip.

We would like to publish your stories (editorial rights reserved) regularly.

My experience in PM World Congress2016

by Prakash Mohan

During the PM-16 Conference of the Powder Metallurgy Association of India in Pune my paper **"Effects of Fe and Mo Content on the microstructure and mechanical properties of Ti-Mo based alloys prepared by elemental blend and mechanical alloying technique"** was selected for the **GRAND PMAI STUDENT AWARD** which was an all-expense paid trip to attend the World PM-2016 Conference organised by the European Powder Metallurgy Association in Hamburg.

Presently I am doing my PhD at UNIVERSITAT POLITECNICA DE VALENCIA, SPAIN. My project work is "Development of a new high performance Titanium alloy (Mainly β-alloy) for dental implants"**.** UPV Spain is a leading institute for engineering students.

My co-operative & friendly guide, Prof. Vicente Amigo Borrais got the "PMAI GUIDING HAND FACULTY AWARD".

I am very fortunate that I could attend the World Congress where several high quality technical papers were presented in all aspects of Powder Metallurgy.

I met with different speakers & industrialists who do amazing work in powder metallurgy such as Prof. Dr. Ing. Frank Petzoldt, head of Fraunhofer IFAM & Dr Marco Actis Grande from Politecnico de Torino. We discussed my award paper at PM16 in India. Both very much appreciated the PMAI idea of promoting students in PM.

PM World Congress 2016

PMAI booked me a room in the comfortable Hotel IBIS Altona which is located in the heart of the city, 15 minutes walking distance from the conference venue.

I visited Hamburg on last day of conference in the afternoon. Hamburg is a beautiful city, a major port in the north of Germany connected to the North Sea by the Elbe River. It's crisscrossed by hundreds of canals and contains large areas of parkland. At its core is the Alster Lake which is dotted with boats and surrounded by cafes. I also travelled by ferry and saw the beautiful Hamburg skyline.

My overall experience was very good & life changing. I recommend young researchers to work in powder metallurgy and participate in PMAI conferences. I give thanks to the PMAI awards committee.

Prakash Mohan (L) with Dr Marco Actis Grande, Associate Professor, Politecnico di Torino, Italy

Technical Article

High Performance PM Gears

by V. S. Maheswaran, PhD Student

Chalmers University of Technology

The performance and life of conventionally manufactured gear wheels are limited by factors such as inhomogeneous microstructure and distribution of inclusions. Powder metallurgy (PM) can solve some of these problems but has faced limitations caused by porosity. In this paper a cost effective way to eliminate porosity by hot isostatic pressing (HIP) without canister has been evaluated with encouraging results.

Material and Methods

The material selected for this investigation was the Höganäs AB grade Astaloy Mo (iron with 1.5 Mo pre-alloyed) which is suitable for gear applications. Standard 100 mesh powder and a finer <63µm fraction was used to investigate the influence of particle size on the HIP-process. The powder was mixed with 0.2C-UF4 to give a composition suitable for carburizing. Two different lubrication systems were used. The first was with 0.6% LubeE, which is a high performance lubricant. The second lubricant system was made as a mix, Densmix, for warm compaction.

Table 1: Material and process parameters

Series	Powder	Lubricant	Sintering
A	Standard	Densmix	1300°C, 1 h
B	Standard	Lube E	1300°C, 1 h
C	Fine	Lube E	1300°C, 1 h
D	Standard	Lube E	1250°C, 1 h

The variants A, C, D were double pressed with 800 MPa in both steps, with an 800°C pre sintering in between. Final sintering was done at 1300°C or 1250°C for 1 hour according to Table 1. Finally the material was "Hipped" at 1150°C for 2 h at 1000 bar. The variant B was single pressed and sintered before HIP. In the present paper manufacturing routes were developed for production of fully dense gear wheels by PM and HIP. The effect of different material and process parameters was investigated and simulation tools for relevant material and processing issues were developed.

Results and Summary

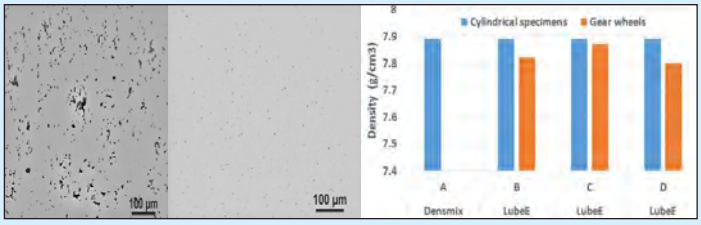

Figure 1: Optical micrographs showing PM after 2nd pressing (left), after HIP-ing (middle) and the density graph for different samples (right)

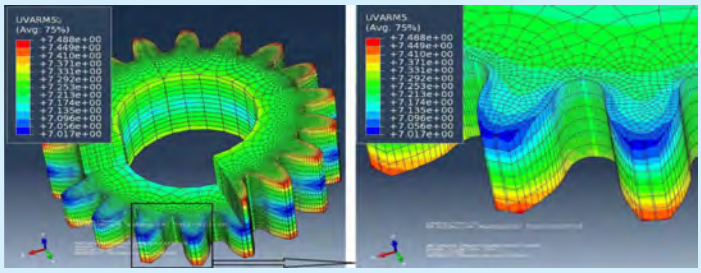

Figure 2: FEM simulation showing the density variation arising after pressing

From Figure 1, the results show after HIP-ing, full density is reached. Also the density plot shows that full density can be reached in case of cylindrical samples. In gear specimens the density seems to vary and the clear evidence for the presence of neutral zone can be seen. This is also simulated in case of FEM simulation of the same gear geometry and the density variation is seen. When it comes to the finer size fraction the variation can be eliminated to a certain extent. It is important to close the surface pores after the second pressing so that after HIP-ing full density can be reached.

Challenges

The challenge when developing a PM process that can be combined with HIP-ing is to get a material with closed porosity so that the gas cannot penetrate the material during the HIP cycle. Otherwise an internal pressure will be created, preventing the pores from closing. The porous nature of the materials also means that there typically is a performance gap compared to wrought steels. But, by combining the HIP technology with PM manufacturing it is possible to get both effective production, with near net shape, with the strength of a pore free material. If such a process can be made cost effective, it will be possible to expand PM into new, more challenging applications. Technologies, such as surface densification through rolling, are also available to improve performance. However, by utilizing the HIP technology it's expected to lift performance even further.

PMAI Participation in Exhibitions

IMTEX 2017, Bangalore
26 Jan to 1 Feb 2017. Stall No: A129.

Automotive Engineering Show 2017, New Delhi
21-23 Marh, 2017

PMAI is Association partner and has a stall to promote Powder Metallurgy. Do please visit our stall.

Manufacturers of PM Powder, PM Parts & equipment for the PM industry may visit http://www.pmai.in/en/supplier_directory.php & fill their details in the PMAI website supplier's directory.

Report on PM Short Course, PMSC-16

at VIT University, Chennai Campus

PMAI conducted the annual PM Short Course at VIT University, Chennai Campus, from Dec 14 – 17, 201 in association with VIT University.

N. Gopinath, President PMAI gave the inaugural address and Dr. Deep Prakash, Secretary, PMAI gave the vote of thanks, followed by welcome address by Dr. K. Janardhan Reddy, Professor and Dean, VIT Chennai campus.

The PM short course was a 4 day program and on the last day program ended with an industrial visit to Fluidtherm Technology for a lecture on and demonstration of atmospheres & furnaces for sintering, sinter hardening and high temperature sintering as well as an overview of PM standards given by Prof. Butee of CoEP.

All the speakers were experts from various Institutions and Industry. 22 participants attended this program from several industries and engineering colleges in spite of the devastating cyclonic storm just 2 days before the course.

Prof. Dhokey explains the mechanisms of sintering

Mr. Gopinath talks on Sintering Furnaces & Atmospheres

PMSC 16 – Course Curriculum

Lecture by	Subject
Dr. P. Ramkrishnan, Emeritus Prof. IIT Bombay	Overview of Powder Metallurgy and Particulate Materials Technology
Mr. Bijoy Sharma, Consultant (Ex. DMRL)	Thermal Methods of Powder Production for PM
Dr. Murli Gopal, Novoken Innovations	Mechanical and Solution Methods of Powder Production for PM
Dr. P. Ramkrishnan, Emeritus Prof. IIT Bombay	Powder Characterization
Mr. Jean Marie Pierson, Dorst Technologies GmbH	Cold Consolidation of Powders
Dr. N. B.. Dhokey, CoEP	Thermal Consolidation of Powders - Sintering Fundamentals
Dr. Deep Prakash, BARC	Binders, Lubricants & Sintering Aids
Mr. Sundar Sriram, Sundram Fastners	High Density, High Performance PM Materials Processing
Mr. Rajendra Sethiya, GKN Sinter Metals	Maintaining Quality in PM Manufacturing
Dr. Deep Prakash, BARC	Fabrication/Shaping Methods for Ceramics
Mr. V. Raghunathan, Fluidtherm	Heat Treatment, Surface Treatment, Processing equipment & Inspection
Dr. D. Srikanth, VIT- Chennai	Porous PM Materials
Mr. Shashikant Jadhav, Maven Tools & Technologies	Design and fabrication of Tooling for PM
Mr. R. Gurunathan, RBL	Friction materials
Mr. Bijoy Sharma, Consultant	PM for Defence and Aerospace Industry
Dr. Deepak Pattanayak, CECRI	Bio-materials
Dr. Deep Prakash, BARC	PM in Nuclear Engineering and Energy Generation
Mr. V. Krishnamoorthy, GE	Soft Magnetic Materials
Mr. Joe Ajay, EOS	Additive manufacturing using powder
Dr. V. Umashankar, VIT-Chennai	Powder Injection Molding
Dr. S. P. Butee, CoEP	Overview of PM Standards
Mr. N. Gopinath, Fluidtherm & President PMAI	Sintering Furnaces & Atmospheres

Automotive Engineering Show 2017, New Delhi

The Automotive Engineering Show will take place in the Nation's capital from 21-23 March 2017 at Pragati Maidan. The show that centers around automotive manufacturing is a must visit for the automotive community.

New Delhi and its surrounding areas boast of India's largest Automotive hub with a lion's share of the market revenues coming from North India. New Delhi, being a central location in this hub, facilitates business by providing easy connectivity to other industrial areas, thus creating an optimum trade environment for the Automotive Engineering Show.

Solutions for Automotive Manufacturing

Innovations are the driving force for mobility in tomorrow's world. Putting forward innovations of the future, the Automotive Engineering Show will cover engineering and automation in vehicle and automotive component manufacturing companies making it a unique 'one of its kind' show in the world.

Fair visiting hours:

21 – 22, March 2017 10 am – 6 pm
23 March 2017 10 am – 5 pm

PMAI is an Association Partner in the Automotive Engineering Show 2017 and has a stall to promote the use of metal powder & PM Parts. Visit our stall.

PM Powder & PM parts manufacturers may visit http://www.pmai.in/en/supplier_directory.php & fill their details in the PMAI website supplier's directory