Preface

Powder metallurgy (PM) of titanium started with Kroll in 1937, who compacted and sintered 14 different binary titanium alloys (Mo, W, Ni, Fe, Co, Be, Si, Mn, Cr, Cu, Al, Zr, V and Ta with additions ranging from 2wt.% to 9wt.%) in argon, soon after he was able to produce about 0.5 kg batches of sponge fines (W. Kroll, Verformbare Legierungen des Titans, Z Metallkunde, 1937, vol. 29, 189–192). The sintered samples (19 mm diameter cylinders) were subsequently hot-rolled into ~1 mm thick strips for ductility assessment. Despite persistent efforts since, the potential of PM to become an important industrial process for the manufacture of titanium products has not been realized. Current tonnage applications of PM Ti parts are limited to just a few products, including automotive engine intake and exhaust valves, warhead casing, seeker housing, and filtration tubes. Co-sponsored by Materials Australia (MA), Titanium Industry Development Association Inc. (TiDA), New Zealand, The Minerals, Metals & Materials Society (TMS), USA, Japan Society of Powder and Powder Metallurgy (JSPM), and the Chinese Society for Metals (CSM), the first major international conference on ***Powder Processing, Consolidation and Metallurgy of Titanium*** was held at The University of Queensland, Brisbane, Australia, 4-7 December 2011.

The objectives of this conference were to provide an international forum to review recent progress in both the fundamental sciences and applications of PM Ti and to discuss future directions. The conference attracted 127 delegates from 15 countries. A total of 78 selected papers were presented. In addition, a 90 min Panel Discussion, chaired by Dr David Whittaker, reviewed the current status of the PM Ti business and the major impediments to future developments, with active participation of the audience. The conference fully achieved its objectives and turned out to be the largest international gathering dedicated to PM Ti.

A wide range of topics were discussed at the conference. These include

- titanium powder production
- titanium powder consolidation by various means
- metal injection moulding of titanium
- titanium for biomedical applications
- PM Ti alloy development
- titanium matrix composites
- additive manufacturing of titanium (cold spray, electron beam melting, laser melting)
- DFT modelling of diffusion in titanium during sintering, and
- fabrication of novel porous titanium structures.

This focus issue of Key Engineering Materials contains 50 peer-reviewed papers. They account for about 60% of the papers presented at the conference. Soon after the conference, in February 2012, Dynamet Technology, Inc., received qualification approval from Boeing for the supply of PM Ti-6Al-4V alloy products, with or without subsequent hot isostatic pressing (HIP), for structural components on commercial aircraft. This is a major milestone in the PM Ti business. Let's hope that the next one will be on the horizon soon.

Ma Qian

The University of Queensland

20 June 2012

Acknowledgements

The publication of this focus issue of Key Engineering Materials is fully funded by the Titanium Industry Development Association Inc. (TiDA), New Zealand.

Special thanks go to the following colleagues for their critical review of the papers:

C. Doblin (CSIRO Process Science and Engineering, Australia)
L.C. Zhang (The University of Western Australia)
T.B. Sercombe (The University of Western Australia)
C. Wen (Swinburne University of Technology, Australia)
DS van Vuuren (The CSIR, South Africa)
K. Kondoh (Osaka University, Japan)
H. Tsukamoto (Nagoya Institute of Technology, Japan)
N. K. Park (Korea Institute of Materials Science, Korea)
Y. Liu (Central South University, China)
A. Dehghan-Manshadi (University of Wollongong, Australia)
E. Pereloma (University of Wollongong, Australia)
E. Gordo (University Carlos III of Madrid, Spain)
T. Ebel (Helmholtz-Zentrum Geesthacht, Germany)
A. T. Sidambe (University of Sheffield, UK)
P. Cao (University of Auckland, New Zealand)
D. L. Zhang (University of Waikato, New Zealand)
P. Ewart (University of Waikato, New Zealand)
S. D. Luo (The University of Queensland, Australia)
Y. F. Yang (The University of Queensland, Australia)
P. Yu (The University of Queensland, Australia)

The conference was co-sponsored by

Materials Australia (**MA**)
Titanium Industry Development Association Inc. (**TiDA**), New Zealand
The Minerals, Metals & Materials Society (**TMS**), USA
Japan Society of Powder and Powder Metallurgy (**JSPM**), Japan
Chinese Society for Metals (**CSM**), China

The international organising committee was composed of

John Barnes (CSIRO, Australia)
Colleen Bettles (Monash University, Australia)
Sammy Chan (University of New South Wales, Australia)
Matthew Dargusch (The University of Queensland, Australia)
Zhigang Zak Fang (University of Utah, USA)
Jim Williams (The Ohio State University, USA)
M. Ashraf Imam (US Naval Research Laboratory, USA)
Orest M. Ivasishin (Institute for Metal Physics, Ukraine)
Katsuyoshi Kondoh (Osaka University, Japan)
Nho-Kwang Park (Korea Institute of Materials Science, Korea)
Xuanhui Qu (University of Science and Technology Beijing, China)
Deliang Zhang (The University of Waikato, New Zealand)
Warwick Downing (TiDA, New Zealand)

Peng Cao (University of Auckland, New Zealand)
Tim Sercombe (University of Western Australia)
Brian Gabbitas (University of Waikato, New Zealand)
Cuie Wen (Swinburne University of Technology, Australia)
Yong Liu (Central South University, China)
Thomas Ebel (Helmholtz-Zentrum Geesthacht, Germany)
Igor S. Polkin, Vils JSC (All-Russian Institute of Light Alloys, Russia)
Elena Gordo (University Carlos III of Madrid, Spain)
Huiping Tang (Northwest Institute for Nonferrous Metal Research, China)
Chong Soo Lee (POSTECH, Korea)
Ali Dehghan-Manshadi (University of Wollongong, Australia)
Elena Pereloma (University of Wollongong, Australia)
George Collins (CAST CRC, Australia)
Ma Qian (The University of Queensland, Australia)

The conference was initiated and co-chaired by

Ma Qian (The University of Queensland, Australia)
Deliang Zhang (University of Waikato, New Zealand)
George Collins (CAST-CRC and Materials Australia)
Warwick Downing (TiDA, New Zealand)

The specially invited Panel Discussion members were

David Whittaker (Chair, UK)
John Barnes (CSIRO, Australia)
Jim Williams (The Ohio State University, USA)
Warwick Downing (TiDA, New Zealand)

The conference secretaries were

Dr Shudong Luo (The University of Queensland, Australia)
Mr Hussein Hamka (Materials Australia)
Ms Tanya Smith (Materials Australia)

Finally, the Powder Metal Science and Engineering Group of The University of Queensland, particularly Miss Xini Yuan, Dr Ya Feng Yang, and Mr Yang Xia, offered substantial assistance to ensure the success of the conference.

TiDA

Titanium Industry
Development Association Inc

"Leading New Zealand's titanium industry to enable the design and development of world-class products using powder metallurgy."

www.tida.co.nz