

Preface

Abrasive machining is one kind of old technology, but it has a far-reaching impact on a broad spectrum of industries. In particular modern manufacturing, there is an ever increasing demand of advanced abrasive technology and other precision abrasive technology. The International Symposium on Advances in Abrasive Technology (ISAAT) is held annually to respond these needs. An emphasis of the ISAAT series is to bring together both academic researchers and practitioners from around the world for interchange of the latest developments and applications in abrasive technologies.

The International Symposium on Advances in Abrasive Technology (ISAAT) was first held in Sydney, Australia in 1997. Since 2002, JSAT and ICAT have been jointly organizing this exciting annual event for this community and the symposia have been successfully held in US, China, Hong Kong, Russia, UK, Turkey, Korea, Japan, Australia, Taiwan, Germany and Singapore. It serves a continuation of promoting the research collaboration and establishing a platform to explore the frontier of abrasive technology.

It is the first time that ISAAT is held in conjunction with Chinese Conference of Abrasive Technology (CCAT). CCAT was sponsored by The Chinese Committee of Abrasive Technology of Production Engineering Institution of Mechanical Engineering Society every two years. The aim of CCAT series is to exchange of new theories, technologies, methods and equipments in the field of abrasive processing, and promote the development of the abrasive technology and its application in China. It is a lead step for exchanging the research experience with assistance of international communication.

Besides abrasive related technologies, advanced cutting machining, electrical discharge machining (EDM), glass molding, machine tool system, ultrasonic machining, laser beam machining, tribology, etc. will be addressed as well in the conference so that the attendees will be benefited and gain more knowledge of up to date fabrication technologies. More than 120 presentations contributed around the world are included in the proceedings.

On behalf of the ISAAT 2013 committee, we are gratitude to Chairman, Professor Xipeng Xu, Co-Chairmen, Professor Jun Wang, Professor Libo Zhou, Professor Ming Chen and Professor Shiming Ji for their support of forming advisors and resources. Special thanks to Professor Hideki Aoyama, Professor Haruhisa Sakamoto, and Professor Akinori Yui for their organizing works of Japan part. Thanks to Associate Professor Binghai Lv and Dr. Qianfa Deng for a lot of secretarial works, also appreciation to Professor Donghui Wen, Professor Zhaozhong Zhou, Professor Ping Zhao, Ms. Tinghong Peng, Ms. Zhufang Fang and Ms. Yingying Ge for their assistance on administrative side to integrate the conference together and make it truly a world-class event. More thanks to Zhejiang Provincial Nature Science Foundation of China for finical support. Last but not least, we would like to express our acknowledge to authors who have devoted to advanced abrasive technology and are willing to share their results and experiences with us.

Prof. Julong Yuan

Chairman, Organizing Committee

**The 16th International Symposium on Advances in
Abrasive Technology (ISAAT 2013)
In conjunction with
The 17th Chinese Conference of Abrasive Technology (CCAT 2013)
23-26 September, 2013, Qiandao Lake, Hangzhou, China**

Organized by

Zhejiang University of Technology, China

Shanghai Jiao Tong University, China

Co- Organized by

Quzhou University, China

National Nature Science Foundation of China

Zhejiang Provincial Nature Science Foundation of China

Sponsored by

International Committee for Abrasive Technology (ICAT) ,

The Chinese Committee of Abrasive Technology(CCAT),CPEI

The Japan Society for Abrasive Technology (JSAT)

Chinese Society of Advanced Manufacturing Technology (CSAMT)

Conference Chairman

X.P. Xu, Huaqiao University, China

Co-Chairman

J. Wang, University of New South Wales, Australia

J.L. Yuan, Zhejiang University of Technology, China

M. Chen, Shanghai Jiao Tong University, China

Conference Organizing Committee

Chairman

J.L. Yuan, Zhejiang University of Technology, China

Co-Chairman

M. Chen, Shanghai Jiao Tong University China

L.B. Zhou, Ibaraki University, Japan

S.M. Ji, Zhejiang University of Technology, China

Members

H. Aoyama, Keio University, Japan

H. Sakamoto, Sophia University, Japan

A. Yui, National Defense Academy, Japan

D.H. Wen , Zhejiang University of Technology, China

B.H. Lv , Zhejiang University of Technology, China

Q.F. Deng , Zhejiang University of Technology, China

P. Zhao , Zhejiang University of Technology, China

T.H. Peng , Zhejiang University of Technology, China

Z.F. Fang , Zhejiang University of Technology, China
Y.Y. Ge , Zhejiang University of Technology, China
Z.Z. Zhou , Zhejiang University of Technology, China
F.F. Zhou , Zhejiang University of Technology, China
Z. Wu , Zhejiang University of Technology, China
W.G. Guo , Zhejiang University of Technology, China
J. Wang , Zhejiang University of Technology, China
W.F. Yao, Zhejiang University of Technology, China
K. Wu, Zhejiang University of Technology, China
M. P. Zhong , Zhejiang University of Technology, China

ICAT MEMBERS (*FOUNDING MEMBER)

Chairman

J. Wang*, The University of New South Wales, Australia

Vice Chairmen

S.C. Salmon*, Next Generation Technology Group Inc., USA

A. Yui, National Defense Academy, Japan

Ordinary member

T. Tawakoli, Hochschule Furtwangen University, Germany

X. P. Xu*, Huaqiao University, China

Secretary-General

L. Zhou*, Ibaraki University, Japan

Immediate past chair

T. Kuriyagawa*, Tohoku University, Japan

Emeritus Chair

K. Suzuki*, Nippon Institute of Tech, Japan

Active Members

X. Chen*, Liverpool John Moores University, UK

M.N. Morgan*, Liverpool John Moores University, UK

D. Walker, University College London, UK

E. Brinksmeier, IWT, University of Bremen, Germany

B. Denkena, IFW, Leibniz Universität Hannover, Germany

A.A. Torrance, Trinity College Dublin, Ireland

H. Yamaguchi, University of Florida, USA

J. A. Webster, Cool-Grind Technologies, USA

H.Z. Choi*, Korea Institute of Industrial Technology, Korea

C. Y. Wang*, Guangdong University of Technology, China

F.H. Zhang*, Harbin Institute of Technology, China

M. Chen, Shanghai Jiao Tong University, China

H. Gao, Dalian University of Technology, China

D.M. Guo, Dalian University of Technology, China

R.K. Kang, Dalian University of Technology, China

C.Z. Huang, Shandong University, China

J.L. Yuan, Zhejiang University of Technology, China

S.H. Yin, Hunan University, China

H. Huang, Huaqiao university, China
J.H. Xu, Nanjing University of Aeronautics and Astronautics, China
F.H. Sun, Shanghai Jiao Tong University, China
Y. Fu, Nanjing University of Aeronautics and Astronautics, China
Y. Gao*, Hong Kong University of Science & Technology, China
P.L. Tso*, National Tsing Hua University, Taiwan
C.C.A Chen, National Taiwan University of Science and Technology, Taiwan
C.L. Chao, Tam-Kang University, Taiwan
D. L. Butler, Nanyang Technological University, Singapore
J. Tamaki*, Kitami Institute of Technology, Japan
K. Kitajima*, Kansai University, Japan
T. Uematsu*, Toyama Prefectural University, Japan
K. Tanaka*, Toshiba Machine Company, Ltd., Japan
H. Suzuki, Chubu University, Japan
J. Yan, Keio University, Japan
Y.B. Wu, Akita Prefectural University, Japan
K. Okuda, University of Hyogo, Japan
M. Iwai, Toyama Prefectural University, Japan
S. Ninomiya, Nippon Institute of Technology, Japan
T. Enomoto, Osaka University, Japan
H. Sakamoto, Sophia University, Japan
K. Ohashi, Okayama University, Japan
H. Aoyama, Keio University, Japan
H. Huang, University of Queensland, Australia
L.C. Zhang, University of New South Wales, Australia
Z.Y. Jiang, University of Wollongong, Australia
X. S. Li, CSIRO Earth Science and Resource Engineering, Australia

Associate Member

Y. Kakinuma, Keio University, Japan
N. Yoshihara, Iwate University, Japan

CCAT MEMBERS

Chairman

X.P. Xu, Huaqiao University, China

Vice Chairmen

Y. Huang, Chongqing University, China
R.K. Kang, Dalian University of Technology, China
F. Zhu, Zhengzhou Research Institute for Abrasives & Grinding, China
J.H. Xu, Nanjing University of Aeronautics and Astronautics, China
J.L. Yuan, Zhejiang University of Technology, China
Z. Lu, Guilin Research Institute of Geology for Mine Resource, China

CCAT Board Ordinary Members

Y.D. Gong, Northeastern University, China
C.Y. Wang, Guangdong University of Technology, China
F.H. Zhang, Harbin Institute of Technology, China

Z.M. Cui, Henan University of Technology, China

B. Zhao, Henan Polytechnic University, China

C.Z. Huang, Shandong University, China

M. Chen, Shanghai Jiao Tong University, China

Y.F. Mai, University of Shanghai for Science & Technology, China

C.Z. Ren, Tianjin University, China

L. Teng, No. 168 Research Institute, Aviation Industry Corporation of China