

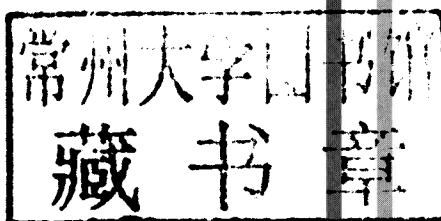
International Advancement in Ultraprecision Machining Process Vol.1



KSMPE



International Advancement in Ultraprecision Machining Process



Welcome to Jeju Island, Korea

China, Japan and Korea are Asia's leading nations in terms of high technology and manufacturing output. It is clear that much of Asia's high value products are heavily reliant on ultra-precision technology and nanotechnology capabilities. I am convinced that the ultra-precision machining technology clearly contributes to a better scientific and technological progress of participating nation.

On behalf of the Chinese production Engineering Institution CMES (CPEI), Japan society for Precision Engineering (JSPE), Korean Society of Manufacturing Process Engineers (KSMPE) and Gyeongnam National University of Science and Technology (GNTECH), we are pleased that this international conference, CJUMP2013 are held in conjunction with the 7th conference of Ultra-Precision(ELID) Technology Research Group(7th UPET conference) in Jeju island of Korea.

CJUMP2013 conference will provide a leading forum for industrialists and academics alike to review the best of China, Japan and Korea's industrial innovation, progressive research and technology developments. Delegates will gain an insight of the ultra-precision engineering and nanotechnology priorities of Asia's leading industrial nation.

I sincerely hope that it will be a forum of active technology cooperation and academic research exchange with China, Japan and Korea in the field of specialized Ultra-Precision technology.

Prof. Tae-soo Kwak
Co-Chairman, Organizing committee of CJUMP2013
Chief of Ultra-Precision(ELID) Technology Research Group
27 March, 2013

C O N T E N T S

Ultraprecision machining and lapping

An Investigation into Ultra Precision Machining Technique of Al6061-T651	14
--	----

Microfabrication

Laser Fabrication with the New Pulsewidth-Tunable Fiber Laser	16
Microstructured Surfaces Fabrication Using Fast Tool Servo System Based Diamond Turning	18
Patterning Collagen Utilizing PELID Method	19

New machining process and system

Development of Electric Rust Preventive Machining Method System - Safe Water Using for Machining Fluid: Complete Removal of Bacteria (Staphylococcus aureus)—	24
Study on Structural and Dynamic Characteristics Analyses of Multi Hole Processing Unit	29
Analysis of Wireless Power Transmission System for Ultrasonic Assisted Grinding Based on FEM	34

Ultraprecision and efficient grinding

The Development and Research of the Special ELID Grinding Machine	42
Optimization of Machining Parameters in High-speed Grinding Based on RSM Model	47

Special ultraprecision polishing

Preliminary Study on Plasma Assisted Polishing of Sapphire	54
Research on Processing Capability of Magnetorheological Polishing Based on Machine Error	59
Investigation of Thermally Oxidized SiO ₂ /4H-SiC (0001) Interface for Surface Flattening	65

Ultraprecision sensing and analysis

Development of High Speed Tool Wear Detection System by using DC Two- Terminal Methods	72
An FEM-SPH Coupling Model for Ultra-precision Cutting of Al6061	77
Flow Visualization of Media Counting Machine and Improvement for Counting Thin Sheet Materials	82

Advanced machining and manufacturing

A Study of Manufacturing Process for the Grinding of Automobile Part	88
Comparisons of Machining Accuracy According to Combination of Feeding Axes Using Ultra-precision DTM	89
Experiment Study on the Influential Factors and Laws of KDP Crystal Surface Quality by Horizontal Fly Cutting	94
The influence of Deformation Induced by Adhesive on Large-aperture Mirror	99

ELID and ultraprecision grinding

A Study on ELID Current Variation in High-effective Grinding Process of Aluminium Nitride Ceramics	106
Tribological Characteristics of Nanodiamond and its Application to Electrolytic in-process dressing (ELID) grinding wheel	107
Exploitation of the ELID Grinding Parameters Expert System	110
Process Experimental Research and Equipment Development of ELID Lapping	115
Nano-grinding for Small Aspherical Lens Mould Using B-axis	120

Lapping and fixed abrasive process

Ultraprecision Lapping for the Zirconia ceramic Plane126

Effect of Grid Size on the Subsurface Damage Depth of K9 Glass Machined by Fixed Abrasive Pad132

Surface properties

Evaluation of Sub-Surface Damaged of Sapphire Wafer by using Chemical-Mechanical Polishing and Etching 138

A Study of Surface Properties on BK7 Glass using Diamond Polishing Process and Mirror-Surface Grinding Process143

Research on Subsurface Defects of KDP Crystal by Single Point Diamond Turning Technique144

Study of Surface Damage Characteristics of Nano-ZrO2 Ceramic by Scratching Tests Assisted by Ultrasonic Vibration150

Biological effect

The Effect of Topographical Condition of TiO2 Substrate on Cell Activity158

Resistance of the Biofilm which occurred in Metalworking Coolant159

Nano-surface fabrication

Characteristics of Pt Thin Films on WC for a Lens Glass Mold by the Ion Beam Assisted DC Magnetron Sputtering166

Size Effect Induced by Nanoindentation on Natural Diamond171

Reconstruction of Nanoscale Displacement Vectors Based on the AFM and DIC Techniques177

Analysis of machining and system

Research and Analysis of the Correction and Calibration of Removal Function in the High-precision Magnetorheological Polishing184

Analysis of Material Removal Effects by Slurry Concentration and Temperature in Fluid Jet Polishing190

Measurement and simulation

Efficient Measurement of Deep Groove with Forth and Back Scanning Method Using Scanning Tunneling Microscopy194

The Simulation Experimental Research on Large Diameter Fresnel Lens Mold Machining199



International Advancement in Ultraprecision Machining Process

Preface

It is our great pleasure to welcome you to the joint international conference of 9th CJUMP and 7th UPET held on March 27-30, 2013, in Jeju, Korea. The CJUMP stands for the CHINA-JAPAN International Conference on Ultra-Precision Machining Process, and was initiated in 1984. The UPET also stands for Conference of Ultra-Precision ELID Technology Research Group. The goal of the conferences is to bring together researchers and academics from China, Korea and Japan to discuss novel theories, technologies and applications in the areas of precision engineering, micro engineering and nano-technology.

This conference is jointly organized by RIKEN MFL, Committee of Precision Engineering & Micro-nano Technology of CPEI, Committee of Ultra-Precision (ELID) Technology Research Group (UPET). Furthermore, co-organizers are The NPS Association (NPS), Chubu University, National University of Defense Technology, Hunan University, Dalian University of Science & Technology, Beijing Machine tools Research Institute, Harbin Institute of Technology, Henan University of Science & Technology, Zhejiang University of Technology.

In order to meet the new requirements of customers, creative research and development work in manufacturing processing technology must be promoted to develop ultra-high-precision mechanical manufacturing technologies capable of producing structures having three-dimensional shapes with ultra-smooth surfaces and extremely precise form accuracy. The conference will provide an excellent platform to share the latest knowledge and ideas on Micro/Nano mechanical engineering by researchers and engineers from both academia and industry. Cooperation and corroboration of the researchers in the Pacific Rim nations will be strongly required.

This volume covers the following areas of interest as the main topics: Single point diamond turning, Ultra-precision grinding technology, High speed and high efficiency machining, Ultra-precision machine design, Machine tools and systems, Coolant and cooling, In-process measurement and monitoring, Metrology and evaluation, Finishing, lapping and polishing, Micro/nano machining and fabrication, Beam-aided polishing processes, Controlling for ultra-precision position, Forming process for optical and electrical components, CMP and silicon wafer processing, Brittle material machining, EDM, ultrasonic machining, laser machining, and surface treatment, and so on.

Almost 50 papers were contributed from around the world. We believe that this volume will be useful for active researchers and engineers to learn the newest applicable information and will stimulate further research into nanomanufacturing technology to create new practical ideas for the beginning of the 21st century.

Finally, I would like to express my sincere gratitude to the Japan Society for Precision Engineering (JSPE) -Committee for nano-precision mechanical manufacturing technology, Chinese Production Engineering Institution, CMES (CPEI), Gyeongnam National University of Science and Technology (GNTECH), The Korean Society of Manufacturing Process Engineers (KSMPE) for their strong support.

村元 常元

Prof. Tsunemoto Kuriyagawa
Chairman of international advisory committee
27 March, 2013

The CJUMP 2013 is expanded by the 9th CJUMP in conjunction with the 7th UPET. The goal of this conference is to bring together researchers and academics from China, Japan and Korea to discuss novel theories, technologies and applications in the areas of precision engineering, micro engineering and nano-technology. We received 22 papers and approximately 40 participants from China. Three leading experts in the field of ultraprecision machining will provide keynote speeches. Their topics include diamond turning, nano grinding, polishing and measurement. It is our pleasure that all participants will enjoy this conference, that they get an overview about the current trends and acquire new ideas for solving their current tasks and problems. In addition, this conference will be an ideal opportunity to meet colleagues or friends from the field of ultra-precision machining and related topics.

Shengyi Li

Professor of National University of Defense Technology

Welcome to Jeju Island, Korea

China, Japan and Korea are Asia's leading nations in terms of high technology and manufacturing output. It is clear that much of Asia's high value products are heavily reliant on ultra-precision technology and nanotechnology capabilities. I am convinced that the ultra-precision machining technology clearly contributes to a better scientific and technological progress of participating nation.

On behalf of the Chinese production Engineering Institution CMES (CPEI), Japan society for Precision Engineering (JSPE), Korean Society of Manufacturing Process Engineers (KSMPE) and Gyeongnam National University of Science and Technology (GNTECH), we are pleased that this international conference, CJUMP2013 are held in conjunction with the 7th conference of Ultra-Precision(ELID) Technology Research Group(7th UPET conference) in Jeju island of Korea.

CJUMP2013 conference will provide a leading forum for industrialists and academics alike to review the best of China, Japan and Korea's industrial innovation, progressive research and technology developments. Delegates will gain an insight of the ultra-precision engineering and nanotechnology priorities of Asia's leading industrial nation.

I sincerely hope that it will be a forum of active technology cooperation and academic research exchange with China, Japan and Korea in the field of specialized Ultra-Precision technology.

Prof. Tae-soo Kwak
Co-Chairman, Organizing committee of CJUMP2013
Chief of Ultra-Precision(ELID) Technology Research Group
27 March, 2013

The 9th Cooperative and Joint international conference on Ultra-precision Machining Process, in conjunction with The 7th Conference of Ultra-Precision (ELID) Technology Research Group



(CJUMP 2013: Joint Conference of 9th CJUMP and 7th UPET)

Jeju Inservice Training Institute of KFCC, Jeju, Korea

March 27-30, 2013

<http://www.cjump2013.info>

Sponsors

Japan Society for Precision Engineering (JSPE) -Committee for nano-precision mechanical manufacturing technology-
Chinese Production Engineering Institution, CMES, (CPEI)
Gyeongnam National University of Science and Technology.
The Korean Society of Manufacturing Process Engineers

Organizers

RIKEN, MFL
Committee of precision engineering & micro-nano technology of CPEI
Ultra-Precision(ELID) Technology Research Council

Co-Organizers

The NPS Association (NPS)
Chubu University
National Univ. of Defense Tech.
Hunan University
Dalian Univ. of Sci. & Tech.
Beijing Machine tools Research Institute
Harbin Institute of Technology
Henan Univ. of Sci. & Tech.
Zhejiang Univ. of Tech.

Supporters

Japan Optomechatronics Association (JOEM)
The Japan Society for Abrasive Technology (JSAT)
Japan Society of Mechanical Engineers (JSME)
Japan Society of Electrical - Machining Engineers (JSEME)

Forword

The CHINA-JAPAN International Conference on Ultra-Precision Machining Process (CJUMP) was initiated in 1984. The goal of the conference is to bring together researchers and academics from China and Japan to discuss novel theories, technologies and applications in the areas of precision engineering, micro engineering and nano-technology.

In 2013, we would like to expand the CJUMP in conjunction with the 7th Conference of Ultra-Precision(ELID) Technology Research Group to be held in Jeju, Korea, which includes topical Invited reports and original paper presentations submitted by Korean researchers and academics.

It is our pleasures that all participants will enjoy this conference, that they get an overview about the current trends and acquire new ideas for solving their current tasks and problems. In addition, this conference will be an ideal opportunity to meet colleagues or friends from the field of ultra-precision machining and related topics.

We are looking forward to meeting you in Jeju, Korea.

Topics

General conference topics will be

- Single point diamond turning
- Ultra-precision grinding technology
- High speed and high efficiency machining
- Ultra-precision machine design
- Machine tools and systems
- Coolant and cooling
- In-process measurement and monitoring
- Metrology and evaluation
- Finishing, lapping and polishing

- Micro/nano machining and fabrication
- Beam-aided polishing processes
- Controlling for Ultra-precision position
- Forming process for optical and electrical components
- CMP and silicon wafer processing
- Brittle material machining
- EDM, ultrasonic machining, laser machining, and surface treatment
- Related precision machining method

Honorary Chairman

Prof. T. Moriwaki, Setsunan Univ.
Prof. Z. J. Yuan, Harbin Institute of Tech.

Special Chairman

Prof. T. Kuriyagawa, Tohoku Univ.
Prof. Y. G. Jung, Changwon National Univ.

Chairman

Prof. H. Ohmori, RIKEN
Academician D.M. Guo, Dalian Univ. of Sci. & Tech.

Co-Chairman

Prof. T. S. Kwak, Gyeongnam National Univ. of Sci. and Tech.
Prof. Y. Namba, Chubu Univ.
Prof. T. Doi, Kyushu Univ.
Prof. Y. Takeuchi, Chubu Univ.
Prof. S. Y. Li, National Univ. of Defense Tech.
Prof. J. L. Yuan, Zhejiang Univ. of Technology
Prof. S. H. Yin, Hunan Univ.
Prof. F. Z. Fang, Tianjin Univ.
Prof. J. Y. Yang, Beijing Machine Tools Research Institute

International advisory committee:**Chairman**

Prof. T. Kuriyagawa, Tohoku Univ.

Members

Prof. H. Ohmori, RIKEN
Prof. J. W. Yan, Keio Univ.
Prof. L. B. Zhou, Ibaraki Univ.
Prof. T. Moriwaki, Setsunan Univ.
Prof. T. Shinmura, Takeo Utsunomiya Univ.
Prof. W. Gao, Tohoku Univ.
Prof. Y. Namba, Chubu Univ.
Prof. B. Zhang, Univ. of Connecticut
Prof. D. X. He, Beijing Machine Tools Research Institute
Prof. H. Huang, Queensland Univ.
Prof. J. Wang, Univ. of New South Wales
Prof. K. Chen, Brunel Univ.
Prof. S. Dong, Harbin Institute of Tech.
Prof. S. H. Yin, Hunan Univ.
Prof. S. Y. Li, National Univ. of Defense
Prof. T. Pang, Harbin Institute of Tech. (Weihai)

Members

Prof. H. Yang, Beijing 303 Research Institute
Prof. J. H. Xu, Nanjing Univ. of Aero. & Astro.
Prof. J. L. Guan, Beijing Univ. of Tech.
Prof. J. Zhao, Jilin Univ.
Prof. J. W. Yu, Hunan Univ.
Prof. K. Chen, Brunel Univ.
Prof. L. X. Fan, Beijing Machine Tool Research Institute.
Prof. L.G. Zheng, CIOMP
Prof. L.H. Zheng, SITP
Prof. L.M. Yan, FOERC
Prof. M. Chen, Shanghai Jiao Tong Univ.
Prof. M. Xu, Fudan Univ.
Prof. Q. L. Zhao, Harbin Institute of Tech.
Prof. Q. S. Yan, Guangdong Univ. of Tech.
Prof. R. K. Kang, Dalian Univ. of Tech.
Prof. S. M. Ji, Zhejiang Univ. of Tech.
Prof. S. To, Hongkong Polytechnic Univ.
Prof. S. L. Zhao, Beijing Machine tools Research Institute
Prof. T. Sun, Harbin Institute of Tech.
Prof. W. Z. Yuan, Northwestern Polytechnical Univ.
Prof. Y. B. Guo, Xiamen Univ.

Prof. X. P. Xu, Huaqiao Univ.
Prof. Y. M. Wang, Tsinghua Univ.
Prof. Y. F. Dai, National Univ. of Defense Tech.
Prof. Hae-do Jeong, Pusan National Univ.
Prof. Deug-woo Lee, Pusan National Univ.
Prof. Nam-kyeong Kim, Gyeongnam National Univ. of Sci. and Tech.
Prof. Yongchul Lee, Yonam Institute of Digital Technology (YIDT)
Prof. Wonsun Seo, Korea Institute of Ceramic Eng. and Tech. (KICET)
Prof. Gyeong-Nyun Kim, Koje College
Prof. S. K. Lyu, Gyeongsang National Univ.
Dr. D. B. Choi, Korea Institute of Machinery and Materials (KIMM)
Dr. T. J. Je, Korea Institute of Machinery and Materials (KIMM)

Organizing committee:**Chairman**

Prof. H. Ohmori, RIKEN

Co-Chairman

Prof. Wonsun Seo, Korea Institute of Ceramic Eng. and Tech. (KICET)
Prof. Tae-soo Kwak, Gyeongnam National Univ. of Sci. and Tech.
Prof. Y.F. Dai, National Univ. of Defense Tech.
G. S. X.X. Wu, CPEI

Members

Dr. E. Shamoto, Nagoya Univ.
Dr. H. Suzuki, Chubu Univ.
Dr. K. Katahira, RIKEN
Dr. Naohiro Nishikawa, Iwate Univ.
Dr. T.F. Zhou, Tohoku Univ.
Dr. W. M. Lin, Gunma Univ.
Prof. S. Wada, RIKEN
Prof. K. Yamamura, Osaka Univ.
Prof. Y. B. Wu, Akita Prefectural Univ.
Prof. Y. H. Zou, Utsunomiya Univ.
Prof. B. F. Ju, Zhejiang Univ.
Prof. C. Y. Wang, Guangdong Univ. of Tech.
Prof. C. Z. Huang, Shandong Univ.
Prof. C. F. Cheung, Hongkong Polytechnic Univ.
Prof. F. H. Zhang, Harbin Institute of Tech.
Prof. G. B. Wang, NSFC
Prof. H. Gao, Dalian Univ. of Tech.

Prof. Y. Q. Tan, Xiangtan Univ.
Prof. Y. Z. Lei, NSFC
Prof. Y. C. Liang, Harbin Institute of Tech.
Prof. Z. J. Feng, Tsinghua Univ.
Prof. Z. J. Jin, Dalian Univ. of Tech.
Prof. Z. X. Zhou, Hunan Univ.
Prof. Z. H. Deng, Hunan Univ. of Sci. & Tech.
Prof. Z. Q. Yin, National Univ. of Defense Tech.
Prof. Hansub Sim, Gyeongnam National Univ. of Sci. and Tech.
Prof. Hae-ji Kim, Gyeongnam National Univ. of Sci. and Tech.
Dr. Jeong-ho Kim,
Korea Photonics Technology Institute (KOPTI)
Dr. Geon-hee Kim,
Korea Basic Science Institute (KBSI)
Dr. Jong-Ryul Lee, Technorise Co., Ltd.
Dr. D. S. Kim, Bangjoo Optics Co., Ltd.
Dr. S. K. Ro, Korea Institute of Machinery and Materials
CEO J. G. Jeong, KAVAS Co., Ltd.
CEO K. H. Yang, IO Solution Co., Ltd.
CEO M. S. Kim, ENERCO Co., Ltd.

Conference Program:
March 28

Time	Room A (Baekrokdam) program	Room B (Eorimok) program
9:00-10:30	Opening Session Chairpersons: Prof.H.Ohmori, Prof.T.S.Kwak, Prof.S.H.Yin Opening ceremony and remarks: Prof. T.Kuriyagawa, Tohoku Univ., Japan Prof. Yeon-Gyu Choo, Head of Industry-Academic Cooperation Foundation, Gyeongnam National University of Sci. and Tech., Korea Prof. Dongming Guo, Vice President of Dalian University of Science and Technology, China “Emergent and theoretical ultraprecision technologies” Special lecture I : Three-dimensional DLC Coating Using Bipolar PBII, Prof. Junho Choi, Dept. of Mechanical Engineering, The University of Tokyo, Japan Special lecture II : The Basic Theory of Controllable Compliant Tools (CTT) Technology of MRF and IBF, Prof. Li Shengyi, National University of Defense Technology, China	
10:30-11:00	Tea break	
11:00-12:30	Session A1: “Ultraprecision machining and lapping” Chairpersons: Prof.Wonseon SEO, Prof.S.Wada A1-1 (Invited report): Development of High Efficiency Lapping Technology for Precision Balls, Prof. Julong Yuan, Zhejiang University of Technology, China A1-2: An Investigation into Ultra Precision Machining Technique of Al6061-T651, Mr. Geun-man Ryu, KBSI, Korea A1-3: Robot Lapping of Off-axis Aspheric Optics with Gaussian Profile tool influence function, Prof. Yong Xu, Shanghai Jiao Tong University, China	
12:30-13:30	Lunch	
13:30-15:00	Session A2: “Microfabrication” Chairpersons: Prof. K.Yamamura, Dr. Hyun Wook Kim A2-1 (Invited report): Laser Fabrication with the New Pulsewidth-Tunable Fiber Laser, Prof. Satoshi Wada, RIKEN, Japan A2-2: Microstructured Surfaces Fabrication Using Fast Tool Servo System Based Diamond Turning, Mr. Miru Kim, Pusan National Univ., Korea A2-3: Patterning Collagen Utilizing PELID Method, Prof. Shinjiro Umezu, Tokai Univ., Japan	
15:00-15:30	Tea break	
15:30-17:00	Session A3: “Advanced ultraprecision micro-machining” symposium Chairpersons: Prof.H.Ohmori, Ms.Y.J.Kim A3-1 (Invited report): New Technology for Functional Interface Creation utilizing Powder Jet Deposition, Prof. Tunemoto Kuriyagawa, Tohoku Univ., Japan A3-2 (Invited report): Magnetic field assisted manufacturing technology, Prof. Shaohui Yin, Hunan Universtiy, China A3-3 (Invited report): An Experimental Study on Polishing of Polycarbonate Plate for Recycling, Prof. Yong Chul Lee, Yonam Institute of Digital Technology, Korea	
17:30-20:00	Banquet	

March 29

Time	Room A (Baekrokdam) program	Room B (Eorimok) program
8:30-10:00	Session 4: “New machining process and system” Chairperson: Dr. Jong yeol Lee, Prof.S.Umezu A4-1: Development of Electric Rust Preventive Machining Method System - Safe Water Using for Machining Fluid: Complete Removal of Bacteria (Staphylococcus aureus) – Dr. N.Nishikawa, Iwate Univ., Japan A4-2: Study on Structural and Dynamic Characteristics Analyses of Multi Hole Processing Unit, Mr. Dong Hong Kim, Jeju National Univ., Korea A4-3: Analysis of Wireless Power Transmission System for Ultrasonic Assisted Grinding Based on FEM, Dr. Zhigang Dong, Dalian University of Technology, China	Session 4: “Special ultraprecision polishing” Chairperson: Prof.S.Kurokawa, Prof.S.H.Yin B4-1: Preliminary Study on Plasma Assisted Polishing of Sapphire, Prof. K.Yamamura, Osaka Univ., Japan B4-2: Research on Processing Capability of Magnetorheological Polishing Based on Machine Error, Dr. Feng Shi, National University of Defense Technology, China B4-3: Investigation of Thermally Oxidized SiO2/4H-SiC (0001) Interface for Surface Flattening, Mr. Hui Deng, Osaka Univ., Japan
10:00-10:30	Tea break	
10:30-12:30	Session 5: “Ultraprecision and efficient grinding” Chairpersons: Dr.N.Nishikawa, Prof.T.S.Kwak A5-1 (Invited report): The UltraFabrication: ELID Grinding Technologies, Prof.H.Ohmori, RIKEN, Japan A5-2: The Development and Research of the Special ELID Grinding Machine, Mr. Zhiwei Wang, Beijing University of Technology, China A5-3: Optimization of Machining Parameters in High-speed Grinding Based on RSM Model, Prof. Jianwu Yu, Hunan Unviersity, China	Session 5: “Ultraprecision sensing and analysis” Chairpersons: Prof. Julong Yuan, Prof.T.Kuriyagawa B5-1: Development of High Speed Tool Wear Detection System by using DC Two- Terminal Methods, Prof. Syuhei Kurokawa, Kyushu Univ., Japan B5-2: An FEM-SPH Coupling Model for Ultra-precision Cutting of Al6061, Dr. Xiaoguang Guo, Dalian University of Technology, China B5-3: Flow Visualization of Media Counting Machine and Improvement for Counting Thin Sheet Materials, Prof. Shinjiro Umezu, Tokai Univ./RIKEN, Japan
12:30-14:00	Lunch	
14:00-18:00	Technical tour	
18:00-20:00	Farewell party	

Poster presentations (March 28-29)

Chairperson: Prof. Y.C.Lee, Assistant: Mr. T.Kobayashi, Ms. N.Nakata

<p>“Advanced ultraprecision technologies”</p> <p>P1: Advanced machining and manufacturing</p> <p>P1-1: A Study of Manufacturing Process for the Grinding of Automobile Part, Dr. Woo-Kang Kim, KBSI, Korea</p> <p>P1-2: Comparisons of Machining Accuracy According to Combination of Feeding Axes Using Ultra-precision DTM, Dr. Tae Jin Je, KIMM, Korea</p> <p>P1-3: Experiment Study on the Influential Factors and Laws of KDP Crystal Surface Quality by Horizontal Fly Cutting, Mr. Wenchang Wang, Beijing University of Technology, China</p> <p>P2: ELID and ultraprecision grinding</p> <p>P2-1: A Study on ELID Current Variation in High-effective Grinding Process of Aluminium Nitride Ceramics, Prof. Tae-Soo Kwak, GNTech, Korea</p> <p>P2-2: Tribological Characteristics of Nanodiamond and its Application to Electrolytic in-process dressing (ELID) grinding wheel, Dr.Teruko Kato, RIKEN, Japan</p> <p>P2-3: Exploitation of the ELID Grinding Parameters Expert System, Zhiwei.Wang, Beijing University of Technology, China</p> <p>P2-4: Process Experimental Research and Equipment Development of ELID Lapping, Mr. Lili Zhu, Beijing University of Technology, China</p> <p>P2-5: Nano-grinding for Small Aspherical Lens Mould Using B-axis, Prof. Shaohui Yin, Hunan University, China</p> <p>P3: Lapping and fixed abrasive process</p> <p>P3-1: Ultraprecision Lapping for the Zirconia ceramic Plane, Prof. Ping Zhao, Zhejiang University of Technology, China</p> <p>P3-2: Effect of Grid Size on the Subsurface Damage Depth of K9 Glass Machined by Fixed Abrasive Pad, Prof. Yongwei Zhu, Nanjing University of Aeronautics and Astronautics, China</p> <p>P4: Surface properties</p> <p>P4-1: Evaluation of Sub-Surface Damaged of Sapphire Wafer by using Chemical-Mechanical Polishing and Etching, Dr. Chul Jin Park, KITECH, Korea</p> <p>P4-2: A Study of Surface Properties on BK7 Glass using Diamond Polishing Process and Mirror-Surface Grinding Process, Ms. Ha Young Kwak, Gyeonghae Girls High School, Korea</p> <p>P4-3: Research on Subsurface Defects of KDP Crystal by Single Point Diamond Turning Technique, Dr. Chaoliang Guan, National University of Defense Technology, China</p> <p>P4-4: Study of Surface Damage Characteristics of Nano-ZrO₂ Ceramic by Scratching Tests Assisted by Ultrasonic Vibration, Prof. Zhao Bo, Henan Polytechnic University, China</p>	<p>P5: Biological effect</p> <p>P5-1: The Effect of Topographical Condition of TiO₂ Substrate on Cell Activity, Mr. Jong Ho Kang, KICET, Korea</p> <p>P5-2: Resistance of the Biofilm which occurred in Metalworking Coolant, Mr. M.Kounosu, San-ai oil Co., Ltd., Japan</p> <p>P6: Nano-surface fabrication</p> <p>P6-1: Characteristics of Pt Thin Films on WC for a Lens Glass Mold by the Ion Beam Assisted DC Magnetron Sputtering, Dr. Soon Sub Park, KITECH, Korea</p> <p>P6-2: Size Effect Induced by Nanoindentation on Natural Diamond, Dr. Wenjun Zong, Harbin Institute of Technology, China</p> <p>P6-3: Reconstruction of Nanoscale Displacement Vectors Based on the AFM and DIC Techniques, Prof. Yongda Yan, Harbin Institute of Technology, China</p> <p>P7: Analysis of machining and system</p> <p>P7-1: Research and Analysis of the Correction and Calibration of Removal Function in the High-precision Magnetorheological Polishing, Mr. Xianyun Zhong, Institute of Optoelectronic Technology of Chinese Academy of Sciences, China</p> <p>P7-2: Analysis of Material Removal Effects by Slurry Concentration and Temperature in Fluid Jet Polishing, Dr. Chunyan Shi, The Institute of Optics and Electronics, Chinese Academy of Sciences, China</p> <p>P8: Measurement and simulation</p> <p>P8-1: Efficient Measurement of Deep Groove with Forth and Back Scanning Method Using Scanning Tunneling Microscopy, Mr. Wule Zhu, Zhejiang University, China</p> <p>P8-2: The Simulation Experimental Research on Large Diameter Fresnel Lens Mold Machining, Mr. Zhide Chen, Beijing University of Technology, China</p>
--	---

Special lectures and Invited reports

Special lectures:

- I: Prof. Junho Choi, Dept. of Mechanical Engineering, The University of Tokyo, Japan
“Three-dimensional DLC Coating Using Bipolar PBII”
- II: Prof. Li Shengyi, National University of Defense Technology, China
“The Basic Theory of Controllable Compliant Tools (CTT) Technology of MRF and IBF”

Invited reports:

- A1-1: Prof. Julong Yuan, Zhejiang University of Technology, China
“Development of High Efficiency Lapping Technology for Precision Balls”
- A2-1: Prof. Satoshi Wada, RIKEN, Japan
“Laser Fabrication with the New Pulsewidth-Tunable Fiber Laser”
- A3-1: Prof. Tunemoto Kuriyagawa, Tohoku University, Japan
“New Technology for Functional Interface Creation utilizing Powder Jet Deposition”
- A3-2: Prof. Shaohui Yin, Hunan University, China
“Magnetic field assisted manufacturing technology”
- A3-3: Prof. Yong Chul Lee, Yonam Institute of Digital Technology, Korea
“An Experimental Study on Polishing of Polycarbonate Plate for Recycling”
- A5-1: Prof. H.Ohmori, RIKEN, Japan
“The UltraFabrication: ELID Grinding Technologies”

MEMO

C O N T E N T S

Ultraprecision machining and lapping

An Investigation into Ultra Precision Machining Technique of Al6061-T651	14
--	----

Microfabrication

Laser Fabrication with the New Pulsewidth-Tunable Fiber Laser	16
Microstructured Surfaces Fabrication Using Fast Tool Servo System Based Diamond Turning	18
Patterning Collagen Utilizing PELID Method	19

New machining process and system

Development of Electric Rust Preventive Machining Method System - Safe Water Using for Machining Fluid: Complete Removal of Bacteria (Staphylococcus aureus)—	24
Study on Structural and Dynamic Characteristics Analyses of Multi Hole Processing Unit	29
Analysis of Wireless Power Transmission System for Ultrasonic Assisted Grinding Based on FEM	34

Ultraprecision and efficient grinding

The Development and Research of the Special ELID Grinding Machine	42
Optimization of Machining Parameters in High-speed Grinding Based on RSM Model	47

Special ultraprecision polishing

Preliminary Study on Plasma Assisted Polishing of Sapphire	54
Research on Processing Capability of Magnetorheological Polishing Based on Machine Error	59
Investigation of Thermally Oxidized SiO ₂ /4H-SiC (0001) Interface for Surface Flattening	65

Ultraprecision sensing and analysis

Development of High Speed Tool Wear Detection System by using DC Two- Terminal Methods	72
An FEM-SPH Coupling Model for Ultra-precision Cutting of Al6061	77
Flow Visualization of Media Counting Machine and Improvement for Counting Thin Sheet Materials	82

Advanced machining and manufacturing

A Study of Manufacturing Process for the Grinding of Automobile Part	88
Comparisons of Machining Accuracy According to Combination of Feeding Axes Using Ultra-precision DTM	89
Experiment Study on the Influential Factors and Laws of KDP Crystal Surface Quality by Horizontal Fly Cutting	94
The influence of Deformation Induced by Adhesive on Large-aperture Mirror	99

ELID and ultraprecision grinding

A Study on ELID Current Variation in High-effective Grinding Process of Aluminium Nitride Ceramics	106
Tribological Characteristics of Nanodiamond and its Application to Electrolytic in-process dressing (ELID) grinding wheel	107
Exploitation of the ELID Grinding Parameters Expert System	110
Process Experimental Research and Equipment Development of ELID Lapping	115
Nano-grinding for Small Aspherical Lens Mould Using B-axis	120

Lapping and fixed abrasive process

Ultraprecision Lapping for the Zirconia ceramic Plane126

Effect of Grid Size on the Subsurface Damage Depth of K9 Glass Machined by Fixed Abrasive Pad132

Surface properties

Evaluation of Sub-Surface Damaged of Sapphire Wafer by using Chemical-Mechanical Polishing and Etching 138

A Study of Surface Properties on BK7 Glass using Diamond Polishing Process and Mirror-Surface Grinding Process143

Research on Subsurface Defects of KDP Crystal by Single Point Diamond Turning Technique144

Study of Surface Damage Characteristics of Nano-ZrO2 Ceramic by Scratching Tests Assisted by Ultrasonic Vibration150

Biological effect

The Effect of Topographical Condition of TiO2 Substrate on Cell Activity158

Resistance of the Biofilm which occurred in Metalworking Coolant159

Nano-surface fabrication

Characteristics of Pt Thin Films on WC for a Lens Glass Mold by the Ion Beam Assisted DC Magnetron Sputtering166

Size Effect Induced by Nanoindentation on Natural Diamond171

Reconstruction of Nanoscale Displacement Vectors Based on the AFM and DIC Techniques177

Analysis of machining and system

Research and Analysis of the Correction and Calibration of Removal Function in the High-precision Magnetorheological Polishing184

Analysis of Material Removal Effects by Slurry Concentration and Temperature in Fluid Jet Polishing190

Measurement and simulation

Efficient Measurement of Deep Groove with Forth and Back Scanning Method Using Scanning Tunneling Microscopy194

The Simulation Experimental Research on Large Diameter Fresnel Lens Mold Machining199

