

Table of Contents

Preface, Committees and Sponsors

Chapter 1: Grinding

Deep Profiled Slot Grinding on a Nickel-Based Alloy with Electroplated CBN Wheels Z.D. Shi, A. Elfizy and H. Attia	3
Experimental Study on the Surface Roughness in Mesoscopic-Scale Grinding of Nickel-Based Superalloy Y.G. Zhou, Y.D. Gong, Y. Sun, Z.X. Zhu and Q. Gao	9
Grinding Behavior of Yttrium Partially Stabilized Zirconia Using Diamond Grinding Wheel P.S.P. Anand, N. Arunachalam and L. Vijayaraghavan	15
Experiment and Finite Element Analysis Research on Surface Roughness in Micro-Grinding H62 X.L. Wen, Y.D. Gong, Y. Sun, J. Cheng and D.C. Ba	21
Research on Grinding Force of Zirconia Internal Grinding with Resin Bond Diamond Wheel H. Wang, K. Zhang, Y.H. Wu and H. Song	30
Dental Grinding of Lithium Disilicate Ceramic Prostheses Using High-Speed Rotary Cutting Instruments in <i>In Vitro</i> Oral Adjusting H.T. Ren, X.F. Song and X.F. Zhang	36
Experiment and Surface Roughness Prediction Model for Ti-6Al-4V in Abrasive Belt Grinding Y.X. Chen, Y. Huang, G.J. Xiao, G.L. Chen, Z.W. Liu and X.M. Liu	42
Grinding for Microstructural Functional Surface X. Chen, H.L. Li, H.Y. Cao, J. Wharton, D. Allanson and Z.Q. Hu	48
Grinding Technology of Cylindrical Surface with Protrusion K. Kato, Y. Maeda and H. Tanaka	54
Experimental Study on Profile Machining of Titanium Alloys with Superabrasive Tools B. Jiang, Y.C. Fu, Z.C. Zhao, B. Ping, H.N. Wang and W.F. Ding	60
Characteristics in Grinding of YVO_4 with a Resin Bond Diamond Wheel M.Q. Zhang, Y.Q. Yu, G.Q. Huang and X.P. Xu	66
Optimizing the Grinding Process through Reduction of the Loading of Grinding Tool by Infiltration B. Azarhoushang, R. Rinderknecht, A. Vesali and J. Struss	71
Forces during Grinding Operation and its Relation to the Dressing Cycle A. Nambiar, K. Matsumoto, M. Yamamoto, K. Ohashi and S. Tsukamoto	78
Experimental Study of Fabrication of Cast-Iron Bonded cBN Grinding Wheels by V-EPC (I) - The Influence Factors on the Qualities of Grinding Layer Q.L. Dai, C.B. Luo and J.F. Liu	84
Optimization and Application of Laser-Dressed cBN Grinding Wheels A. Zahedi, B. Azarhoushang and J. Akbari	90
Experimental Investigation on Bronze-Bonded CBN Formed Grinding Wheel by Means of Electro-Discharging Dressing J.W. Yu, L.H. He, H. Luo and S.H. Yin	97
Recyclability and Performance Stability of Corrosion Inhibition Improved Amine-Free Water-Soluble Cutting Coolant K. Yamaguchi, T. Fujita, Y. Kondo, S. Sakamoto, S. Tsukano and M. Yamaguchi	104

Chapter 2: Abrasive Jet Machining

An Investigation of Hole Machining Process on a Carbon-Fiber Reinforced Plastic Sheet by Abrasive Waterjet K. Thongkaew, J. Wang and G.H. Yeoh	113
--	-----

Investigation of Decision Criteria for Abrasive Conditions in Multi-Small-Hole Drilling of CFRP by Blast Process	
H. Fukagawa, T. Hirogaki, K. Shimizu and K. Nishikawa	119
Control of Machining Profiles Based on Material Removal Capabilities in Cylindrical Blasting	
M. Harada, K. Ohashi, T. Fukushima and S. Tsukamoto	125
Study on Effect of Viscoelastic Properties on Surface Roughness Uniformity in Abrasive Flow Machining for Plate Surface	
X.P. Wang, Y.Z. Fu and H. Gao	131

Chapter 3: Advanced Cutting Technology

Influence of Fiber Orientation on Machined Surface Quality in Milling of Unidirectional CFRP Laminates	
C.Y. Wang, L. Wen, C.D. Wang, H.Z. Zhang, Q.L. An and M. Chen	137
Influence of Pulsed Magnetic Treatment on Wear of Carbide Micro-end-Mill	
Z.Q. Liang, L.P. Ma, X.B. Wang, W.X. Zhao, T.F. Zhou, P. Yan and L. Jiao	143
Milling Force and Machining Deformation in Mirror Milling of Aircraft Skin	
Y. Bao, Z.G. Dong, R.K. Kang, Z. Li and Y.C. Yuan	149
Molecular Dynamics Simulation of a Cutting Method by Making Use of Localized Hydrostatic Pressure	
J. Shimizu, K. Uezaki, L.B. Zhou, T. Yamamoto, T. Onuki and H. Ojima	156
Machining Accuracy and Cutting Temperature Property in Deep Hole Drilling of Stainless Steel	
T. Yamaguchi, K. Okuda, H. Kodama, T. Yamamoto and T. Takeda	162
Tool Wear Characteristics of Cylindrical Cutting of Nickel-Based Super Alloy	
S. Yamada, Y. Maeda, T. Motoyoshi, H. Tanaka, K. Kato and T. Yazawa	168
Influence of Endmill Tool Run-Out to Machining Accuracy in Micro-Groove Milling	
D. Goto, Y. Maeda, K. Iwatsuka, T. Motoyoshi, H. Tanaka, K. Kato and T. Yazawa	173
Influence of Tool Shape on Cutting Characteristics in Ultra-Precision Cutting of Al-Mg Alloys	
T. Iida, Y. Maeda, D. Hirase, T. Motoyoshi, H. Tanaka, K. Kato and T. Yazawa	178
Study on Machining Single-Crystal Nickel by Molecular Dynamics Simulation	
Z.X. Zhu, Y.D. Gong, Z.H. Gan, Y.G. Zhou and G.Q. Yin	184
Proposal of Tilt Helical Milling Method for Hole Creation of Carbon Fiber Reinforced Plastic (CFRP)	
Y.B. Wu, Q. Wang and M. Nomura	190
Experimental Study on Surface Quality in Micro-Milling of Single Crystal Superalloy	
Q. Gao, Y.D. Gong and Y.G. Zhou	196
End-Milling of CFRP/Ti-6Al-4V with Electroplated cBN Tool	
T. Furuki, T. Hirogaki, E. Aoyama, K. Ogawa, K. Inaba and K. Fujiwara	203
Proposal of Constant Load Feeding Method as a High Precision Cutting Tool for CFRP	
Y. Kondo, Y. Doi, T. Adachi, S. Sakamoto, K. Yamaguchi, T. Fujita and M. Yamaguchi	209
Temperature Field Study of Hole Drilling in Kevlar Composites	
Y.J. Bao, Y.N. Zhang, H. Gao and X.S. Liu	215
Influencing Factors of Surface Generation in Ultra-Precision Fly Cutting	
L. Zhan, F.H. Zhang, C.H. An and Z.P. Li	221
Development of a New Burnishing Method Utilizing a Flank Face of a Turning Tool and its Burnishing Performance	
M. Iwai, H. Hashimoto and K. Suzuki	227
Experimental Study on Thermal and Force Characteristics in the Dry Slotting of Cortical Bone	
L. Wen, Z.H. Zhao, J.B. Song, D.D. Yu, M. Chen and S.G.F. Shen	233
Effect of Diamond Coating on Drilling Force and Temperature during High Speed Micro Drilling of Bone	
Z.H. Zhao, L. Wen, J.B. Song, D.D. Yu, M. Chen and S.G.F. Shen	239
Face Turning of Cobalt-Free Tungsten Carbide Using Nano-Polycrystalline Diamond Tool	
A. Yui, T. Kitajima and K. Yoshitomi	245

Study on High Speed Milling of Steam Turbine Blade Materials T. Kimura, T. Sawa and T. Kamijyo	251
Synthesis and Characterization of AlMgB₁₄-Ni₃Al Composites for Cutting Tool Materials Y.M. Zhou, F.L. Zhang, P.C. Li, K. Bai and S.H. Wu	257

Chapter 4: Processing of Brittle Materials

Chip Formation during Precision Cutting of Metallic Glass H. Kodama, K. Okuda and T. Inada	265
Characterization of KDP Crystal Surfaces from Single Point Diamond Milling G.Q. Xu, Z.W. Liu, J. Wang and C.Z. Huang	271
Experimental Investigation at Relatively High Speed Scratching Induced by a Developed Diamond Tip Z.Y. Zhang, B.Y. Yuan, S.L. Huang and Z.F. Shi	277
Study on the Ductile Removal Behavior of K9 Glass with Nano-Scratch Z.P. Li, H. Zhao and F.H. Zhang	282
FEM Stress Analysis of Interfacial Failure of Multilayered Thin Film Structures in Nanoscratching C.W. Kang and H. Huang	289
Experimental Study on Effects of Translational Movement on Surface Planarity in Magnetorheological Planarization Process S.H. Yin, Y.Q. Wang, Y.P. Li and S. Gong	293

Chapter 5: Chemical Mechanical Polishing, Processing of Semiconductor Wafer

Fundamental Micro-Grooving Characteristics of Hard and Brittle Materials with a Fine Wire Tool S. Sakamoto, K. Hayashi, Y. Kondo, K. Yamaguchi, T. Fujita and T. Yakou	299
Effect of Citric Acid in Chemical Mechanical Polishing (CMP) for Lithium Tantalate (LiTaO₃) Wafer H.S. Lee	305
Study on Sapphire Wafer Grinding by Chromium Oxide (Cr₂O₃) Wheel K. Wu, N. Yamazaki, Y. Ebina, L.B. Zhou, J. Shimizu, T. Onuki, H. Ojima and T. Fujiwara	311
Study on Removal Mechanism of Sapphire in Plasma Assisted Polishing C. Kageyama, K. Monna, H. Deng, K. Endo and K. Yamamura	317
Polishing of Aluminum Alloy Using Photocatalyst and Cathion Dye under Ultraviolet Irradiation T. Tanaka	321
Study on the Influence of pH on MRR Based on Acidic Slurry in CMP of 304 Stainless Steel J.X. Su, J.G. Yao, Z.K. Wang, L.J. Ma and S.F. Fu	327
Study on the Slicing of Sapphire Using a Wire Tool M. Shinya, T. Yazawa and T. Otubo	333
Numerical Analysis of Slurry Flow and Contact Pressure in CMP Considering the Effects of Retaining Ring C. Li, P. Zhou, Z.J. Jin, B. Zhang and S.J. Shi	338
Theoretical Research on Contact Length in the Rocking Motion Wire Saw H. Huang, S.L. Zheng and X.P. Xu	343
Study on Precision Slicing Process of Single-Crystal Silicon by Using Dicing Wire Saw T. Suzuki, T. Otsuki and J.W. Yan	350

Chapter 6: Electrical Discharge Machining, Ultrasonic and Beam Machining

Experimental Study on Ultrasonic Vibration-Assisted Grinding of High Volume Fraction SiCp/Al Composites Micro-Hole S.X. Lu, H. Gao, C. Sun, Y.J. Bao and Z.C. Bao	359
Fundamental Investigation of Ultrasonic Assisted Surface Grinding of Inconel 718 S.S. Li, Y.B. Wu and M. Nomura	365
Machining Technology of Ultrasonic Assisted Grinding for a Silicon Carbide Wafer Carrier C.J. Ting, C.F. Chen, T.H. Chou, T.C. Wu and T.H. Lin	371
The Effect of Fiber Laser Machining Parameters on Thermal-Affected Zone of Carbon Fiber Reinforced Plastic H. Yuki, K. Sakai and H. Shizuka	377
Development of EDT Equipment Using Wire Tool Electrode Y. Takada, M. Shinozaki, M. Ota, K. Egashira, K. Yamaguchi and Y. Hattori	384
Effect of Cutting Speed on Ultrasonically Added Turning in Soft Magnetic Stainless Steel K. Hara and H. Isobe	390
Study on the Specific Energy Characteristics of the Ultrasonic Vibration Assisted Sawing Ceramic J.Q. Wang, J.Y. Shen, Z.C. Li and X.P. Xu	394
A Study on Ultrasonic Torsional Vibration-Assisted Abrasive Waterjet Polishing of Ceramic Materials Y. Wang, H.T. Zhu, C.Z. Huang, J. Wang and P. Yao	400
Analysis and Optimization of Surface Roughness in Rotary Ultrasonic Burnishing of Titanium Alloy Ti-6Al-4V J. Zhao and Z.Q. Liu	406
Electrical Discharge Dressing (EDD) of Metal Bonded Diamond Arc Grinding Wheels F.H. Zhang, K. Wang, Z.D. Liu, Z.K. Ma and D.R. Luan	412
High Efficiency EDM of PCD Utilizing a Specific Transition Metal Electrode M. Iwai, H. Hashimoto and K. Suzuki	418
Hybrid Process of Laser Heat Treatment and Forming of Thin Plate with a Small Power Semiconductor Laser R. Oda, T. Hirogaki, E. Aoyama and K. Ogawa	423
Controllability Study of Single-Crystal Diamond Cutting Tool Focus Ion Beam Milling with Different Beam Current and Tilting Angle S.Y. Baek, W.K. Choi, Y.J. Choi and E.S. Lee	430
Drilling of Microholes Using Diamond Grinding Tools K. Egashira, R. Okina, K. Yamaguchi and M. Ota	435
Controlled Fabrication of Micro/Nano-Structures on Germanium Using Ultrashort Laser Pulses under Ambient Conditions M. Sivakumar and J. Wang	440
Precise Machining Method by Combining EDM and Grinding with a Rotary PCD Segment Tool for Cemented Carbide F. Koga, S. Ninomiya and K. Suzuki	446

Chapter 7: Finishing, Lapping and Polishing

Nano-Precision Polishing of Oxygen-Free Copper Using MCF (Magnetic Compound Fluid) Slurry Y.L. Wang, Y.B. Wu and M. Nomura	455
Influence of Components on the Rheological Property of Shear Thickening Polishing Slurry B.H. Lyu, W.T. Dai, H.Z. Weng, M. Li, Q.F. Deng and J.L. Yuan	461
Development of Polishing Tool Capable of Self-Adaptive to Processing Site Using Steel Balls and Magnetic Force L. Ma, T. Furuki, T. Kure, T. Hirogaki and E. Aoyama	466
Investigation of Abrasive Super Finishing under Various Paths with a 5-Axis Closed-Link Compact Robot and Fine Diamond Stone T. Liu, T. Kure, T. Hirogaki, E. Aoyama and Y.D. Liu	472
Surface Roughness and Topography of Honed Nickel-Based Superalloy C.Y. Yang, Y.C. Fu, D.S. Huang, J.H. Xu, N.G. Yang and W. Yan	478

Experimental Research on Flexible Polishing by Compound Diamond Powder R.L. Xiang, T.F. Zhou, Z.Q. Liang and X.B. Wang	484
Ultraprecision Machining of Si₃N₄ Ceramics with Shear-Thickening Polishing M. Li, B.H. Lyu, J.L. Yuan and P. Zhao	490

Chapter 8: Surface and Subsurface Integrity and Materials Characterization

Surface and Subsurface Integrity of Glass-Ceramics Induced by Ultra-Precision Grinding B. Zhao, S. Gao, R.K. Kang, X.L. Zhu and D.M. Guo	497
Wet-Etching Evaluation Method of Subsurface Damage after Grinding of Glass R. Sekiguchi, S. Yoshikawa, K. Higashi, N. Miki, Y. Kakinuma, M. Fukuta and K. Tanaka	503
A Study on Residual Stresses in Machined Brittle Material P.L. Tso and T.Y. Tsai	509
Study on the Inherent Correlations of the Material Properties for Silicon Nitride Ceramic Balls J.L. Yuan, L.F. Yu, F. Li, F.F. Zhou, P. Zhao and W. Hang	515
High-Speed Capturing of Stress Distribution of Workpiece under Ultrasonically Assisted Cutting Condition H. Isobe and K. Hara	520
Surface Integrity of AlSiC Composites Ground by Monolayer Brazed Diamond Wheels F.L. Zhang, P. Liu, P. Wang, Y.M. Zhou, H.P. Huang and J.B. Lu	526
Coupled Thermal-Mechanical Analysis of CO₂ Laser Irradiation on Fused Silica R.Q. Li, P. Yao, H. Meng, J. Wang, K. Zhang, C.Z. Huang, B. Zou and H.L. Liu	531
Surface Integrity of the Compressor Blade when Employing Different Polishing Method G.J. Xiao, Y. Huang, Y.X. Chen, G.L. Chen, Z.W. Liu and X.M. Liu	537
The Dynamic Mechanical Properties of Oxygen Free Copper under the Impact Load Q.F. Liu, N.C. Wang, L. Yan, F. Jiang and H. Huang	543
Study on Mechanical Properties of Single-Crystal Silicon Carbide by Nanoindentation M. Matsumoto, H. Harada, K. Kakimoto and J.W. Yan	549
Wear Mechanisms in Grinding of PCBN B. Denkena, T. Grove and L. Behrens	555
Improving Tool Wear Resistance in Inconel 718 Cutting by Considering Surface Microstructures of CBN Cutting Tool T. Sugihara, S. Takemura and T. Enomoto	561
Effect of Carbide Orientation on Sliding Wear Behaviour of High Chromium Cast Iron Z.Y. Jiang, X.J. Gao, D.B. Wei, S.L. Li, H.M. Zhang, J.Z. Xu, D. Wu and S.H. Jiao	567
Enhanced Tribological Performance of CVD Diamond Films Enabled by Using Graphene Layers as Solid Lubricant S.L. Chen, B. Shen and F.H. Sun	573

Chapter 9: In-Process Measurement and Monitoring, Metrology

Wide Range and Accurate Measurement of Wafer Thickness Gauge Using Optical Spectral Analyzer T. Onuki, Y. Ebina, H. Ojima, J. Shimizu and L. Zhou	581
Measurement of the Temperature Distribution at the Tool-Chip Interface by Using a Cutting Tool with Seven Pairs of Built-In Micro Cu/Ni Thermocouples J. Shinozuka and H. binti Jaharadak	586
In-Process Monitoring of the Machining State in Superfinishing by Measuring the Dynamic Machining Forces T. Onishi, K. Ohashi, K. Higashi, Y. Morinaka, S. Banno, T. Kitagawa and S. Tsukamoto	592
Experimental Study of the Causes for Shape Error of a Large Workpiece Machined by Surface Grinding T. Onishi, Y. Shimizu, M. Sakakura, M. Harada, Y. Nakano, S. Baba, K. Ohashi and S. Tsukamoto	597

Measuring Method of Distribution of Abrasive Grain Cutting Edge by Means of AE Sensors T. Yamada, H.S. Lee and K. Miura	601
Investigation of End-Milling Process Based on Monitoring Method with Wireless Telegraphic Multifunctional Tool Holder and Infrared Thermography M. Shindou, R. Matsuda, T. Furuki, T. Hirogaki and E. Aoyama	606
The Use of Power Monitoring and Electron Microscopy in Evaluating the Performance and Fracture Characteristics of Abrasive Grains J. Badger, R. Drazumeric and P. Krajnik	612
Fabrication of Computer Generated Hologram for Aspheric Surface Measurement Z.Y. Zhang, X. Yang and L.G. Zheng	620
Development of In-Process Monitoring System for Grinding Wheel Surface Temperature and Grinding State Y. Fukuhara, S. Suzuki and H. Sasahara	624
Matching Algorithm for Profile Error Calculation of Blade Surface X. Yang, X.L. Liu, J.M. Liu, S.J. Ji, X.T. Qu and Z.Y. Zhang	630

Chapter 10: Machine Tools and Systems, Tooling Processing

Investigation of Control Methods of Chatter Vibration Based on Analysis of End-Milling Chatter Mark R. Shiota, T. Furuki, T. Hirogaki and E. Aoyama	639
Sensorless Cutting Force Estimation in Large Scale Ball-Screw-Driven Machine Tool Y. Yamada, Y. Kakinuma, T. Ito, J. Fujita, A. Tada and M. Sagara	645
Optimization of Control Gains in Numerical Control H. Aoyama and D. Zhang	651
Loop Stiffness of Grinding Machine Developed for 450 mm Silicon Wafers J. Kusuyama, S. Iwahashi, T. Kitajima, N. Ogasawara, A. Yui, H. Saito and A.H. Slocum	655
Development of Direct Drive Motor for Machine Tools and its Performance in Machining T. Ikegami, T. Hirogaki and E. Aoyama	661
New Development of Supersonic Surface Grinding Machine Tool with a Linear-Motor-Driven Table System L. Yang, Y.C. Fu, J.H. Xu and Y.T. Liu	667
Improvement of Surface Roughness with Micro-Axial Vibration of Spindle by Pressure Pulsation of Grinding Fluid Supplied through inside of Wheel K. Nomura, N. Takeuchi, A. Kusakabe, M. Chino and H. Sasahara	673
Internally Cooled Toric Tools for Grinding of Medical Ceramics B. Denkena, T. Grove and L. Tatzig	678
Process Automation in Computer Controlled Polishing D. Walker, G.Y. Yu, C. Gray, P. Rees, M. Bibby, H.Y. Wu and X. Zheng	684