applied sciences

MDPI

Editorial

Special Issue on Laser Micro/Nano Machining Technology

Jianlei Cui

State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, Xi'an 710049, China; cjlxjtu@mail.xjtu.edu.cn

Through the interaction between lasers and materials, laser micro/nano machining technology changes the materials' physical state and properties. It can achieve shape and property control on a micro/nano-scale. Because the energy density, space and time scale of lasers and other aspects tend to be higher, the physical and chemical methods used in the machining process differ from those of traditional manufacturing. It promotes new machining concepts, principles, methods, and technologies, which can have unprecedented effects and constantly surpass the limits of the manufacturing scale. Laser micro/nano machining can not only meet the manufacturing requirements with precision and high surface quality, but can also solve the manufacturing problems of special processing objects, such as complex shape profiles and ultra-small components. Therefore, laser micro/nano machining technology is becoming an irreplaceable method with high precision, high quality and high consistency.

This Special Issue aimed to introduce the latest technological progress and innovative applications in various fields, including laser drilling/cutting/milling/writing, laser surface micro/nano texturing, laser micro/nano additive manufacturing, laser micro/nano welding and joining, etc.

A total of twelve research papers in various fields of high-precision machining, laser ablation processes, functional surface preparation, manipulation of nanomaterials, optoelectronics devices, nanomaterial welding, functional material preparation, functional material machining by laser water jets, nano-scale spatial positioning of nanomaterials and laser processing control-system design are presented in this Special Issue. Chen et al. [1] reported that a discrete-time sliding-mode variable structure controller based on a decoupled disturbance compensator was successfully designed to address the slow step-responses of a galvanometer scanner with disturbance and parameter perturbation and that it has great significance in high-precision machining. Yin et al. [2] reported that the influence of three process parameters on the nanosecond pulse laser ablation of 40Cr13 was investigated and back propagation neural networks predicted the ablation results. Yi et al. [3] reported that micro/nanostructured titanium alloy surfaces with anti-reflection properties were prepared by laser processing technology, which are expected to be applied in bionic devices and microfluidics. Wang et al. [4] simulated electric and force fields at the tips of metallic probes irradiated by polarized laser output from a scanning near-field optical microscope probe, which shows it has the potential for realizing optical manipulation. Guan et al. [5] proposed an approach for soldering ZnO nanowires through femtosecond laser irradiation of Ag nanoparticle solder and provided a method for developing more metal oxide nanowire functional devices in the future. Li et al. [6] compared sandblastings and laser ablation to the surface of Al alloys and found that laser surface treatment could improve the adhesion on Al alloys. Cheng et al. [7] adopted laser water jets to machine SiC/SiC ceramic matrix composites (CMCs), providing primary technical support for high-quality machining of CMCs. Hu et al. [8] established a positioning error model of a laser processing platform for micro crystal resonators (MCR) using the Monte Carlo method and built a laser processing platform whose frequency modulation performances met the engineering requirements. Yang et al. [9] proposed an iterative optimization algorithm

Citation: Cui, J. Special Issue on Laser Micro/Nano Machining Technology. *Appl. Sci.* **2022**, *12*, 13013. https://doi.org/10.3390/app122413013

Received: 8 December 2022
Accepted: 15 December 2022
Published: 19 December 2022

that combines Laguerre–Gaussian modes and Zernike polynomials to optimize the image information entropy of the double-helix point-spread function position and carried out a position imaging experiment using CdTe/CdS/ZnS quantum dots, which validated the effectiveness of the algorithm. Hu et al. [10] took a laser processing control system for microcrystal resonator (MCR) frequency modulation as the research object and designed and optimized the performance requirements and overall structure of the control system. Wang et al. [11] established a laser scribing depth model based on thermal energy balance that can be directly used in the laser NC system to realize the adaptive adjustment and accurate control of laser energy according to the actual laser speed. Li et al. [12] carried out theoretical and experimental investigations into the laser waterjet (LWJ) scribing of monocrystalline silicon, which contributed to the understanding of LWJ processing of silicon on a small scale and broadened the application prospects of LWJ for treating other semiconductor devices.

Although submissions for this Special Issue have been closed, more in-depth research in the field of laser micro/nano machining technologies continues to address the challenges we face today, including nanostructure and function integration, cross-scale and curved complex micro-structure manufacturing and novel applications in micro/nano devices.

Funding: This research received no external funding.

Acknowledgments: Thanks to all the authors and peer reviewers for their valuable contributions to this Special Issue 'Laser Micro/nano Machining Technology' and to all the staff and people involved in this Special Issue. Finally, special thanks to Xuesong Mei and Wenjun Wang.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Chen, G.; Wang, Y. Control of a Digital Galvanometer Scanner Using a Discrete-Time Sliding-Mode Variable-Structure Controller Based on a Decoupled Disturbance Compensator. *Appl. Sci.* **2021**, *11*, 9788. [CrossRef]
2. Yin, Z.; Liu, Q.; Sun, P.; Wang, J. Study on Nanosecond Laser Ablation of 40Cr13 Die Steel Based on ANOVA and BP Neural Network. *Appl. Sci.* **2021**, *11*, 10331. [CrossRef]
3. Yi, J.; Zhou, H.; Han, X.; Mao, J.; Zhang, Y. Laser Fabrication of Titanium Alloy-Based Photothermal Responsive Slippery Surface. *Appl. Sci.* **2022**, *12*, 608. [CrossRef]
4. Wang, G.; Ding, Y.; Long, H.; Guan, Y.; Lu, X.; Wang, Y.; Yang, L. Simulation of Optical Nano-Manipulation with Metallic Single and Dual Probe Irradiated by Polarized Near-Field Laser. *Appl. Sci.* **2022**, *12*, 815. [CrossRef]
5. Guan, Y.; Wang, G.; Zhao, S.; Wang, L.; Ding, Y.; Yang, L. The Realization of ZnO Nanowires Interconnection through Femtosecond Laser Irradiation of Ag Nanoparticles Solder. *Appl. Sci.* **2022**, *12*, 1004. [CrossRef]
6. Li, G.; Lei, M.; Liang, C.; Li, K.; Li, B.; Wang, X.; Wang, J.; Wei, Z. Improving Adhesive Bonding of Al Alloy by Laser-Induced Micro–Nano Structures. *Appl. Sci.* **2022**, *12*, 1199. [CrossRef]
7. Cheng, B.; Ding, Y.; Li, Y.; Yang, L. Theoretical and Experimental Investigation on SiC/SiC Ceramic Matrix Composites Machining with Laser Water Jet. *Appl. Sci.* **2022**, *12*, 1214. [CrossRef]
8. Hu, J.; Li, Z.; Wu, Y.; Yu, X.; Li, G. Error Model and Frequency Modulation Characteristics Analysis of Laser Processing Platform for Micro Crystal Resonator. *Appl. Sci.* **2022**, *12*, 1304. [CrossRef]
9. Yang, J.; Du, H.; Chai, Z.; Zhang, L.; Li, B.Q.; Cui, J.; Mei, X. Optimization of Spot Efficiency of Double-Helix Point Spread Function and Its Application in Intracellular Imaging. *Appl. Sci.* **2022**, *12*, 1778. [CrossRef]
10. Hu, J.; Guo, S.; Fang, B.; Yu, X.; Gu, Z.; Li, G. Design and Optimization of Laser Processing Control System and Process Parameters for Micro Crystal Resonator Frequency Modulation. *Appl. Sci.* **2022**, *12*, 2162. [CrossRef]
11. Wang, J.; Liu, Q.; Sun, P.; Ning, Z.; Wang, L. Study on Model and Experimental of Laser Scribing Parameter of Maskant in Chemical Milling for Aerospace Applications. *Appl. Sci.* **2022**, *12*, 2914. [CrossRef]
12. Li, Y.; Ding, Y.; Cheng, B.; Cao, J.; Yang, L. Numerical and Experimental Research on the Laser-Water Jet Scribing of Silicon. *Appl. Sci.* **2022**, *12*, 4057. [CrossRef]