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Editorial

Special Issue on Advancements in Laser-Based Additive Manufacturing Technologies

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As a unique and powerful heat source, lasers are very important for the surface modification, re-manufacturing, and direct fabrication of 3D components. Recently, laser-based additive manufacturing technologies for R&D and industrial applications have been attracting more attentions from academia and industry. Laser-based additive manufacturing is an interdisciplinary research area in optoelectronics, mechanical engineering, materials science, control, topology design, numerical computing, and other fields. Various issues need to be addressed to guarantee the metallurgical and mechanical properties and performance of the additively manufactured components.

This Special Issue aims to provide a platform for researchers to share the latest advancements in laser-based additive manufacturing technologies. The topics include novel designs, simulations, artificial intelligence, processes, and the development of hardware and industrial applications.

In total, five papers covering various field of laser-based additive manufacturing have been published in this Special Issue. Chen et al. [1] presented their research on the design and fabrication of a micromixer in a pipe shape with internal structure using a laser powder bed fusion (L-PBF) process. Both CFD simulation and chemical experimental methods were employed. The design freedom and manufacturing capability resulting from the use of the L-PBF technique can improve the mixing efficiency and reacting stability of the component. The adoption of artificial intelligence in additive manufacturing is a very popular topic. Zhang et al. [2] conducted a review of the state-of-the-art digital twins developed for additive manufacturing. They pointed out that the first generation of digital twins is still under development. This technology is able to advance additive manufacturing. However, more research needs to be carried out on developing models, databases, machine learning, the integration of the equipment, and algorithms to deal with the data and predict the results. Additive manufacturing could be also of great importance in tissue engineering. Ji et al. [3] presented their study of the design and fabrication of polyglycolic acid (PGA) modules on the basis of the Raschig ring as a tissue element for bottom-top tissue engineering to increase the feasibility of cellular-assembly technology. They concluded that the proposed module design and selective laser sintering process provided a better mass transfer and possessed the required mechanical strength to support their use in the construction of large tissues. Chen et al. [4] reported a laser re-melting process for the thermally sprayed $FeCrCoNiTiAl_{0.6}$ high-entropy alloy coating. They found that the laser re-melted coating possessed a compact microstructure, and remarkably, the pre-existing pores and micro-cracks were eliminated, resulting in an improvement of the wear resistance. The optical head is a key component in a laser directed energy deposition system. Yang et al. [5] reported the multi-physics modelling of an in-house developed laser head for laser-aided additive manufacturing (LAAM) with coaxial wire feeding. The results show that the proposed design approach is effective in obtaining optimal solutions for the optical performance of the laser head. Furthermore, the design and optimization approach can be easily extended to include other parameters such as the materials of

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the optical and mechanical components to minimize the thermal-induced effects in laser material processing.

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References

1. Chen, X.; Wang, D.; Mai, J.; Chen, X.; Dou, W. High-Efficient Micro Reacting Pipe with 3D Internal Structure: Design, Flow Simulation, and Metal Additive Manufacturing. *Appl. Sci.* **2020**, *10*, 3779. [CrossRef]
2. Zhang, L.; Chen, X.; Zhou, W.; Cheng, T.; Chen, L.; Guo, Z.; Han, B.; Lu, L. Digital Twins for Additive Manufacturing: A State-of-the-Art Review. *Appl. Sci.* **2020**, *10*, 8350. [CrossRef]
3. Ji, J.; Pang, Y.; Sutoko, S.; Horimoto, Y.; Sun, W.; Niino, T.; Sakai, Y. Design, Fabrication, and Evaluation of Polyglycolic Acid Modules with Canals as Tissue Elements in Cellular-Assembly Technology. *Appl. Sci.* **2020**, *10*, 3748. [CrossRef]
4. Chen, L.; He, D.; Han, B.; Guo, Z.; Zhang, L.; Lu, L.; Wang, X.; Tan, Z.; Zhou, Z. Effect of Laser Remelting on Wear Behavior of HVOF-Sprayed $FeCrCoNiTiAl_{0.6}$ High Entropy Alloy Coating. *Appl. Sci.* **2020**, *10*, 7211. [CrossRef]
5. Yang, J.; Yao, X.; Cai, Y.; Bi, G. Multiphysics Modeling, Sensitivity Analysis, and Optical Performance Optimization for Optical Laser Head in Additive Manufacturing. *Appl. Sci.* **2021**, *11*, 868. [CrossRef]