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Editorial

Laser Shock Processing and Related Phenomena

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1. Introduction and Scope

Laser Shock Processing (LSP) is continuously developing as an effective technology for improving the surface and mechanical properties of metallic alloys and is emerging in direct competition with other established technologies, such as shot peening, both in preventive manufacturing treatments and maintenance/repair operations.

The level of maturity of Laser Shock Processing has been increasing during the last few years, and several thematic international conferences have been organized (the 7th ICLPRP held in Singapore, June 17–22, 2018, being the last reference), where different developments on a number of key aspects have been discussed, i.e.:

- Fundamental laser interaction phenomena;
- Material behavior at high deformation rates/under intense shock waves;
- Laser sources and experimental processes implementation;
- Induced microstructural/surface/stress effects;
- Mechanical and surface properties experimental characterization and testing;
- Numerical process simulation;
- Development and validation of applications;
- Comparison of LSP to competing technologies;
- Novel related processes.

All these aspects have been recursively treated by well-renowned specialists, providing a firm basis for the further development of the technology in its path to industrial penetration.

However, the application of LSP (and related technologies) to different types of materials, envisaging different types of applications (ranging from the always demanding aeronautical/aerospatial field to the energy generation, automotive, and biomedical fields), still requires extensive effort in the elucidation and mastering of different critical aspects, thus deserving a great research effort as a necessary step prior to its industrial readiness level.

The present Special Issue of *Metals* in the field of "Laser Shock Processing and Related Phenomena" aims, from its initial launching date, to collect (especially for the use of LSP application developers in the different target sectors) a number of high-quality and relevant papers representing present state-of-the-art technology also useful to newcomers in realizing its wide and relevant prospects as a key manufacturing technology.

Consequently, and in an additional and complementary way to papers presented at the thematic ICLPRP conferences, a call was made to those authors willing to prepare a high-quality and relevant paper for submission to the journal, with the confidence that their work would become part of a fundamental reference collection providing the present state-of-the-art LSP technology.

The result is now available and the Special Issue has been completed, with two review and nine full research papers, really setting reference knowledge for LSP technology and covering the practical

totality of open issues leading the present-day research at worldwide universities, research centers, and industrial companies.

2. Contributions

As a first section, two review articles are included, representing, on one side, the previous history of developments of LSP technology [1] and, on the other, an analysis based on such developments of the prospects for the industrial implementation of the LSP technique in critical reliability applications [2]. It is needless to say that these two review papers were written by two of the most renowned experts in the LSP field—i.e., Dr. Clauer was one of the original inventors of the LSP technique at Batelle Columbus Labs. (USA) in the 1970s, and Dr. Sano was the scientist responsible for one of the most impressive research programs on the application of the LSP technique to the nuclear industry in Japan in the last 25 years.

In the second section (comprising nine full research papers), we aimed to compile as representative as possible coverage of the different key aspects leading the present-day research in LSP technology and related disciplines. The result has been a collection of articles ranging from the study of fundamental physics aspects (mostly laser–plasma interaction diagnosis and plasma pressure development, respectively represented by the articles of Colón et al. [3] and Sadeh et al. [4]); passing through the application of numerical modelling to the predictive assessment of the results of the application of LSP to the most relevant present-day materials (represented by the articles of Langer et al. [5] and Angulo et al. [6]); continuing on to the theoretical and experimental analysis of the parametric space of LSP in view of realistic applications (represented by the articles of Kallien et al. [7], Troiani and Zavatta [8], and Petan et al. [9]); and, finally, arriving at two of the most advanced developments at present day in the industrial application of LSP (i.e., the articles of Le Bras et al. [10] and T. Sano et al. [11]). In short, a collection of first-rank articles covering fundamental processes, numerical modelling, microstructural and material-related issues, materials and standard specimens testing, parametric applications design, advanced LSP applications, and implementation issues has been obtained.

3. Conclusions and Outlook

According to the initial spirit of the Special Issue, it is desired and hoped that this collection results in an useful reference tool, complementing and updating previous similar issues of the journal and forming a solid and reliable basis for further thematic research in the field

Conflicts of Interest: The authors declare no conflict of interest.

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