Laser Shock Processing: An Emerging Technique for the Improvement of the Mechanical Behaviour and In-Service Performance of High-Added-Value Metallic Alloys

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Profiting by the increasing availability of laser sources delivering intensities in the GW/cm2 range and with pulse energies in the range of several Joules, Laser Shock Processing (LSP) is consolidating as an effective technology for the improvement of mechanical properties and in-service behaviour of high-added-value metallic alloys and is being developed as a practical process amenable to production engineering. The main acknowledged advantage of the LSP technique consists on its capability of inducing a relatively deep compression residual stresses field into metallic alloy pieces allowing such improved mechanical behaviour.

Following a short description physical foundations of the technique, the set of theoretical/computational methods developed by the authors for the predictive assessment and experimental implementation of LSP treatments will be presented, Subsequently, the experimental facilities used at the UPM for the practical implementation of LSP processes will be presented and some representative results on the residual stress profiles and associated properties modification successfully reached in typical materials (specifically Al and Ti alloys) under different LSP irradiation conditions will be referred.

It is expected that the presentation of the LSP technique serves as a fruitful and enlightening starting point for the development of new research on the improvement of the in-service behaviour of critical metallic components (as, i.e. in the energy, aerospace and biomedical fields).

Biography:

Prof. Dr. Ing. José L. Ocaña is MSc. (1979) and PhD. (1982) in Industrial Engineering (Energy) at the Polytechnical University of Madrid (Spain). Chair Professor of Mechanical Engineering at the ETSII-UPM School of Engineering and Founder Director of the UPM Laser Centre at this University.
He has actively promoted and participated in national (Spain) and worldwide R&D initiatives in the field of scientific and industrial applications of high power lasers, especially in high intensity laser-matter interaction, laser surface treatments, laser micromachining and on-line monitoring and control of industrial laser applications. As a result, he is author/coauthor of more than 250 scientific papers and more than 300 communications in the field of laser technology and applications.