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IMPROVEMENT OF FATIGUE LIFE AND SURFACE PROPERTIES OF METALLIC MATERIALS OF BIOMEDICAL INTEREST BY LASER SHOCK PROCESSING

J.L. Ocaña[1], J.A. Porro[1], M. Díaz[1], I. Angulo[1], F. Cordovilla[1], D. Peral[1],
J.L González-Carrasco[2,3], M. Lieblich[2]

[1] UPM Laser Center. Polytechnical University of Madrid. Ctra. Valencia, km. 7.3. 28031 Madrid. Spain
[2] National Center for Metallurgical Research (CENIM-CSIC), Avda Gregorio del Amo, 8. 28040 Madrid. Spain
[3] Center for Networked Research on Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), Spain
e-mail: jlocana@etsii.upm.es

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Abstract: Laser shock processing (LSP) is increasingly applied as an effective technology for the improvement of metallic materials' mechanical and surface properties in different types of components, mostly as a means of enhancement of their fatigue life behavior. As reported in previous contributions by the authors [1,2], a main effect resulting from the application of the LSP technique consists in the generation of relatively deep compression residual stresses fields into metallic components allowing an improved mechanical behaviour. On their side, bio-mechanical components (i.e. spinal, knee and hip prostheses) are key elements definitely improving the quality of life of human beings traditionally subject to mechanical and functional designs based primarily on intuitive medical approaches, not always optimized from an engineering point of view. Laser Shock Processing (LSP) uses the high peak power of short pulse lasers to generate an intense shock wave into the material finally leading to the generation of a compressive residual stresses field definitely protecting the component against crack initiation and propagation, thus improving its mechanical response and in-service fatigue life. In the present paper, developments in the field of Laser Shock Processing application to several metallic materials of biomedical interest are presented along with results showing the induced surface and mechanical properties modifications interesting in view their high reliability performance.

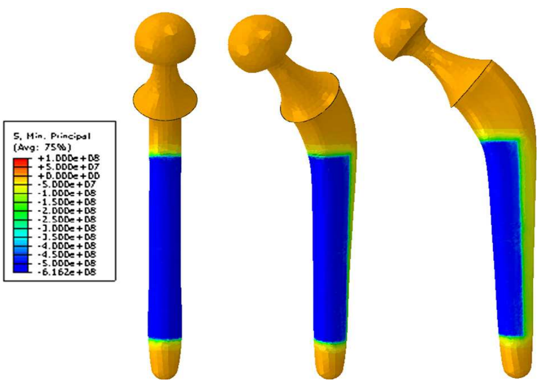

Fig. 1. Numerical simulation of surface residual stresses induced in a hip replacement by LSP [3]

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