Nanosecond Pulsed Fibre Laser Engraving of Ceramics

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Laser engraving is technique that allows to improve the physicochemical properties of the ceramic materials, e.g., adhesion, biointegration, hardness and beside corrosion, wear and fiction resistances. For these reasons, this technology is employed by numerous industries as, aerospace, biomedical, automotive and naval. The properties of the laser engraved materials are determined by the characteristics of the cells, e.g., shape, width or diameter, morphology and defects (cracks and pores). The features of the cells are defined by laser beam-material interaction. The energy fluence threshold, energy depth penetration and incubation factor are parameters that represent the laser beam-material interaction. Thus, the knowledge of these parameters allow the design of the physicochemical properties of the materials. These parameters depend on the chemical and physical properties of the material, as well as the properties of the laser beam. For these reasons, the laser beam-material interaction parameters for different materials, were studied in the present work. The cells were carried out at various energies per pulse and various number of the pulses with a nanosecond pulsed fibre laser. The cells were analysed via optical microscopy and optical profilometry. The energy fluence threshold, incubation factor and energy depth penetration were estimated via statistical analysis (liner regression) of the width or diameter and depth of the cells produced. The energy depth penetration and energy fluence threshold were calculated for single pulse. Furthermore, these parameters were reduced with the increasing of pulse number. With knowledge of these parameters for a given ceramic material, it is possible to determine suitable laser engraving parameters for a particular application.