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Generation of Nanostructures in Metallic Surfaces using Subnanosecond UV Laser ProcessingA. Cubero, L. Porta-Velilla, M. Castro, L.A. Angurel, G.F. de la Fuente, E. Martínez, R. Navarro*¹Instituto de Ciencia de Materiales de Aragón, ICMA (CSIC-University of Zaragoza), 50018 Zaragoza, Spain
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The development of short-pulse lasers has opened new possibilities in the functionalization of materials surfaces. Laser-induced Periodic Surface Structures (LIPSS) are a common phenomenon observed in a broad range of materials, when their surfaces are irradiated with these lasers. The adequate control of the nanostructures generated on the surface of the material allows obtaining new properties that are useful in different fields: induce colour, iridescence behaviour, modify hydrophilic or hydrophobic properties or improve resistance to microorganisms.

In this work we present the rich surface structure phenomenology that has been observed when the surface of different metals (Nb, Ni, steel) is irradiated with a subnanosecond (300 ps) UV laser, and how it affects some of their properties. The influence of different laser parameters, as the laser polarization direction, the pulse irradiance, laser scanning speed and the overlapping in the perpendicular direction, have been studied and a complete set of nanostructures have been defined. Laser treatments have been performed in air, ~~but also~~ in controlled atmospheres (Ar, N₂) or with the surface immersed in liquids (Vaseline oil, water) observing that the generated nanostructures are different depending on the particular experimental conditions imposed. An important effort has been carried out in order to obtain homogeneous nanostructures over extended areas, using a new laser line scanning protocol. In these studies, it has been observed that not only the laser parameters affect the generated nanostructure, but some materials properties are also important. Combining laser treatments with EBSD studies it has been demonstrated that crystallography also plays an important role in the generated nanostructure, observing that the level of interaction of the laser with a particular grain has some correlation with its crystallographic order. It has been also observed that, ~~in~~ depending on the properties of the materials, nanostructures can be modified by the application of external electromagnetic fields.

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