NANO- AND MICRO-STRUCTURING OF SILICON BY LASER-INDUCED PLASMA

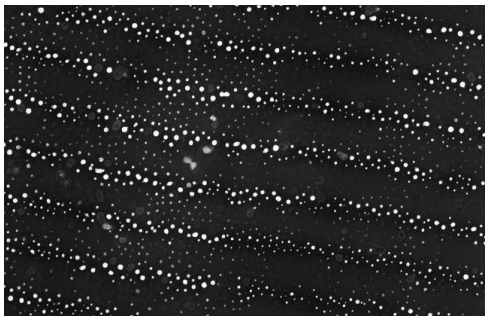
Description:

Nanostructuring of a surface by laser irradiation is an area of ??primary interest in nanotechnology. Many studies have been conducted on the formation of more or less ordered, or periodic, nanostructures when a metallic or semiconductor substrate is irradiated with pulsed laser light. Such is the case, for example, of the formation of micro- and nano-grooves in silicon substrates. This type of structure has been obtained with techniques based on laser scanning microscopes with ultrashort pulses (in the order of a few hundred femtoseconds). Furthermore, the formation of nano-scale conical structures or columns has been extensively studied under various experimental conditions. However, all of these processes are dependent on the atmosphere present during irradiation, as well as on the fluence and pulse duration of the laser. In this invention, a plasma is used as an effective optical medium for laser nanostructuring of silicon surfaces. Specifically, a laser-induced plasma is used as a non-linear optical element that is traversed by a second laser beam. By varying some parameters, such as the time delay between the two laser beams or the fluence of the laser that generates the plasma, the different micro- and nanometric patterns on the silicon surface are controlled.

Keywords:
Laser, Nanotechnology, Nanostructures, Optical Components, Plasma, Silicon

Sectors:
Engineering, Chemistry, Others

Areas:
Industrial, Nanotechnology, Chemistry, New technologies, Materials, Synthesis and procedures



Advantages:

In this invention, a simple plasma lensing technique is proposed to obtain multiple nanostructuring effects without the need to use ultrashort laser pulses (femtoseconds) or particular experimental conditions such as controlled atmosphere. The possibility of performing nanostructuring in situ is of high value and opens up new avenues in the emerging field of plasma-based optical components, such as plasma mirrors and optically controlled plasma diffraction gratings.

Uses and Applications:

The present invention falls within the emerging field of plasma-based optical components and the field of Nanotechnology. There is a recent trend to use this type of nanostructured materials for the generation of X-rays, the acceleration of ions and the study of plasmons in high intensity laser-matter interaction.

Patent Number: ES2559327B2
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Filing Date: 18/12/2014
Protection Level: National (Spain)
Processing Status: Spanish patent