**Influence of laser plasma parameters on the formation of nanoscale structures on metal surfaces**

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This work investigates the effect of laser plasma parameters on the formation of nanostructures on the surface of metals. Laser plasma parameters such as laser energy, laser wavelength, pulse duration and plasma density have been studied extensively to understand their impact on the morphology and size of the nanostructures formed on the metal surface. The experimental results show that the laser energy and laser scanning speeds have a significant effect on the formation of nanostructures. With higher laser energy and shorter wavelength, the size of nanostructures decreases. Additionally, the plasma electron density also plays a key role in the formation of nanostructures. We analyze the plasma emission spectra by calculating the electron density and temperature at conditions that correspond to the formation of laser-induced periodic surface structures (LIPSS) and nanospikes on the surface of the metals. The parameters of the induced plasma plumes were estimated for regular LIPSS and nanospkies on the surface of the titanium target. At relatively low concentration of free electrons in the plasma of Ti target, nanospikes formation was observed. It was previously shown that the formed nanospikes circumference of the ablated area was based on the lowest of the fluence of Gaussian beam. The formation of the nanospikes on the surface of Ti can also correlate with the decrease in the electron density of the plasma plumes during the ablation at the low-scanning speed of the ablating femtosecond laser pulses This study provides important insights into the fundamental processes involved in the formation of nanostructures on metal surfaces, which can be useful in various applications such as catalysis, sensing, electronics, sensing, optoelectronics and others.

Keywords: Laser-induced periodic surfaces structures, nano structures, plasma parametrs