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Wavelength Dependence of Femtosecond Laser-Induced Periodic Surface Structures formed on Tungsten and Copper Surfaces

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The report deals with the dependence of the period of the laser-induced periodic surface structures (LIPSS) on wavelength of incident laser radiation with the aim to make another step in the elucidation of the nature of LIPSS formation. The dependence of the LIPSS period on the wavelength of laser radiation could reflect the dispersion dependence of surface plasmon polaritons (SPPs) that take part in the interference of the incident light with surface scattered waves in the most accepted model of LIPSS formation. LIPSS on copper and tungsten have been obtained under an irradiation of linearly polarized Ti:sapphire femtosecond laser of fundamental (800 nm), second (400 nm) and third (266 nm) harmonics in air environment. The morphology of the sample surfaces has been analysed using scanning electron microscopy. It has been discovered some surface peculiarities. In particular, we partly obtained the structure that resembled spikes but not LIPSS at Cu surface under third harmonic of femtosecond laser. The preliminary obtained experimental data for tungsten in the spectral range from 266 nm to 800 nm demonstrate linear dependence of SPPs dispersion that represents the initial part of the theoretical dependence for SPPs in the range of values of k from 0 to 0.5 (in relative units). Another feature of the experimentally obtained linear dispersion law is the non-passage of the extrapolated line through the origin of coordinates. In particular, this indicates the existence of additional peculiarities (for instance, oxide films, surface tension) of the formed LIPSS on the metal surface.

Topics

Session A. Physics of condensed matter and spectroscopy

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