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The book consists of the abstracts of plenary, oral and poster contributions to the XXX International Conference on Interaction of Intense Energy Fluxes with Matter (March 1–6, 2015, Elbrus, Kabardino-Balkaria, Russia). The reports deal with the contemporary investigations in the field of physics of extreme states of matter. The following topics are covered: interaction of intense laser, x-ray and microwave radiation, powerful ion and electron beams with matter; techniques of intense energy fluxes generation; experimental methods of diagnostics of ultrafast processes; shock waves, detonation and combustion physics; equations of state and constitutive equations for matter at high pressures and temperatures; low-temperature plasma physics; physical issues of power engineering and technology projects.

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CHAPTER 1. POWER INTERACTION WITH MATTER

scribe this complex dynamics we use an advanced specially developed hybrid method based on combination of atomistic and continual approaches. The atomistic system describes the evolution of a target irradiated by the laser pulses, takes into account melting, evaporation, nucleation and recoil effects while electronic subsystem is responsible for correct description of the laser energy absorption, thermal conductivity process and electron–phonon coupling. The results of simulation of the double-pulse ablation obtained for different delays from 1 to 100 ps correlate with the experimental findings.

MECHANISMS OF LASER PEELING OF THIN FILMS FROM SUBSTRATE AND FORMATION OF NANOBUMP

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The report is devoted to the studies of laser peeling of thin 10-100 nm films. To describe better the particularity of our subject, it is valuable to present shortly general picture of laser structuring. It is known, that the structuring of materials by short laser pulses with duration in the range of 10 fs - 1 ps has many important technological applications. But underlying physics is not well understood. On our view, the corresponding processes are some mixture and interplay of plasmon enhanced absorption from one side and a thermomechanical triplet from another side, where the triplet is: (i) spallation, (ii) capillary deceleration in tandem with (iii) diffusion limited freezing. Particular morphology of structures depends on absorbed fluence F_{abs} and number of pulses. Formation of the structures is usually attributed to plasmon activity, which leads to the LIPSS (laser induced periodic surface structures, ripples) [1]. On our opinion, plasmons only *dominate* in the interplay if absorbed fluences are small and multiple repetion is used. Indeed, the chaotic (not ripples) structures are produced by X-ray pulse where plasmon excitation is not possible [2]. Therefore the wavelength should be added into the list of parameters governing morphology of irradiated surface. It was shown [2] that for the small number of pulses, either large F_{abs} or short wavelength λ the chaotic structures different from ripples are formed. Another important governing parameters are connected with geometrical limitations. They are a radius of a focal spot R_L on a irradiated surface and film thickness which fixes spallation depth

if the film is mechanically weakly linked to a substrate. Indeed, surface structures have the finite lateral sizes of $\sim 0.1-1$ um. Therefore for tightly focused optical light pulses $R_L \sim \lambda \sim$ um, the structures have to change qualitatively, see [3] and Refs. therein. In the report the physics of the peeling is considered and the new (relative to [3]) results are presented.

1. Sipe et al., Phys. Rev. B 27, 1141 (1983); Akhmanov et al., Sov. Phys. Uspekhi 28, 1084 (1985).
2. Inogamov et al., J. Phys.: Conf. Ser. 510, 012041(2014); ibid v. 500, 112070(2014).
3. Inogamov et al., JETP Lett. 100, 4 (2014); JETP 120, 15 (2015).

ATOMISTIC SIMULATION OF SURFACE MODIFICATION BY LASER PULSE: COMPARISON OF MODELS WITH VARIOUS SCALES

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In this work the femtosecond laser pulse modification of surface is studied for aluminium (Al) and gold (Au) by use of two-temperature atomistic simulation. The results are obtained for various atomistic models with different scales: from pseudo-one-dimensional to full-scale three-dimensional atomistic simulation. The surface modification after laser irradiation can be caused by ablation and melting. At low energy of laser pulse, the nanoscale ripples on surface may be induced by the melting without laser ablation. The nanoscale changes of the surface are due to the splash of molten metal under temperature gradient. The laser ablation occurs at a higher pulse energy when a crater is formed on the surface. There are essential differences between Al ablation and Au ablation. The swelling and voids formation as the first step at the shock-wave-induced ablation is obtained for both metals. However, the simulation of ablation in gold shows the existence of additional nonthermal type of ablation which is associated with electron pressure relaxation. This type of ablation takes place at surface layer, at a depth of several nanometers and does not induce swelling.