Ablation of LiF and CsI by EUV Nanosecond Laser Pulse

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Abstracts: *In this paper we present results of study interaction of nanosecond EUV laser pulses at wavelength of 46.9 nm with lithium fluoride (LiF) and caesium iodide (CsI) samples. The laser beam is focused with a spherical Si/Sc multilayer coated mirror on samples. Samples was irradiated by 1, 2, 5, 10 and 20 laser shots at various fluence values. At the same time laser ablation plumes were observed. Ablation craters on the surface of the LiF and CsI samples were analysed by atomic force microscope (AFM).*

Laser ablation using nanosecond pulses have been studied extensively since 1960s. The laser-target interaction involves many processes, including heating, melting, vaporization, ejection of particles, and plasma creation and expansion. The depth of laser ablation crater over which the laser energy is absorbed, and thus the amount of material removed by a single laser pulse, depends on the material's optical properties and the laser wavelength and pulse length. Usually, plasma cloud induced by laser irradiation consists of excited or ground-state neutrals, electrons, and ions. The properties of the plume, e.g. the mass distribution, ion and atom velocity, and the angular distribution of the plume species, play an important role for applications of laser ablation in mass analysis of laser-induced plasma and in the production of thin films by pulsed laser deposition. Focused visible/IR laser pulses are absorbed in the expanding plasma plume at densities 100 - 1000 times smaller than the solid density. But, EUV laser pulses penetrate into the solid and create plasma directly at the solid density.

In this paper, we investigate an interaction of nanosecond EUV laser pulses with the LiF and CsI samples. As a source of laser radiation was used discharge plasma driver CAPEX (CAPillary EXperiment) based on high current capillary discharge in argon. The laser beam is focused with a spherical Si/Sc multilayer coated mirror on samples. Laser ablation of the samples has been performed by 1, 2, 5, 10 and 20 laser pulses at various fluence values. Subsequently, laser ablation craters were analysed by AFM microscopes. All ablation plumes from the sample surface were registered by photo camera Canon EOS 5D Mark II and macro lens Canon EF 100 mm f/2.8 Macro USM. It was found that even lower laser pulse energy is sufficient for creation of visible ablation plume on the surface of LiF and CsI samples.