Laser ablation on the edge of Cu target

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An UV nitrogen laser beam (337 nm, 6 ns (FWHM), (3.2 ± 0.2) mJ) was focused with a quartz lens (f = 100 mm) onto a flat Cu target and onto the edge of the same target. The target was situated in air at normal pressure. The irradiated surfaces were studied by means of a scanning electron microscope (SEM).

The laser-beam energy density on the Cu target was not uniform over the cross-section of the focal spot. The damage of the target after irradiation with laser beams with a repetition in frequency of 1 Hz were inspected in the area of the craters and on the parts in direct vicinity of the maximum irradiation.

Fig. 1. shows the solidificated crater on the free Cu surface after 100 laser pulses. Numerous self-organized closed loop vortex filaments [1] are visible on the inner side of crater. The number of vortex filaments increase with number of pulses. They are caused by Rayleigh-Taylor instability. A rim of the crater is surrounded by droplets and caverns. The "vertical" columns of relief due to Kelvin-Helmholtz instability were also observed.

In the second part of the experiment the laser beam was focused on the edge of the target in a shape of letter "V", Fig. 2. The target was rude cut off without a polishing. After 100 pulses the surface topography shows a consequence of capillary waves i.e. droplets and caverns (Fig. 2.). Damage is also visible on the reversed side of the target (Fig. 3.) as self organized hollow bolls with diameters from 1.3 μm to 1.5 μm.

Subsequent laser pulses resulted in the formation of the crater on the flat surface in the area irradiated by highest energy density. We suppose that the bolls on the edge of the Cu target where the Cu layer is thin enough, are caused by the copper conductivity.

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1. S. Lugomer, Laser-matter interaction, Profil, Zagreb (2001).

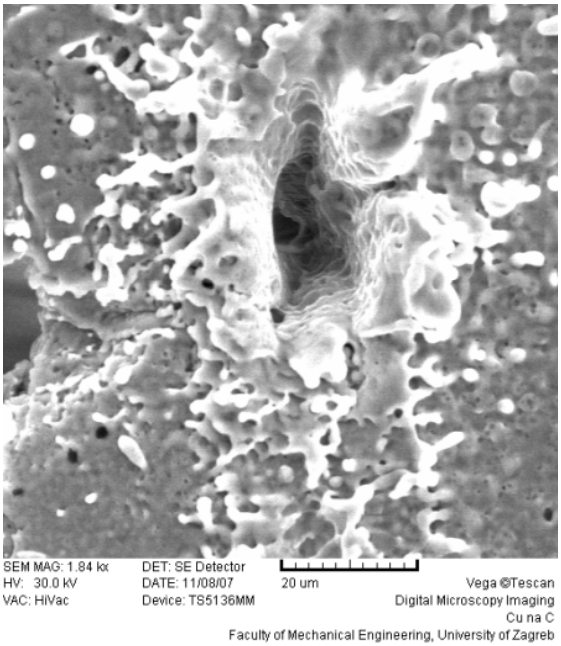

Figure 1. Crater on the free Cu surface

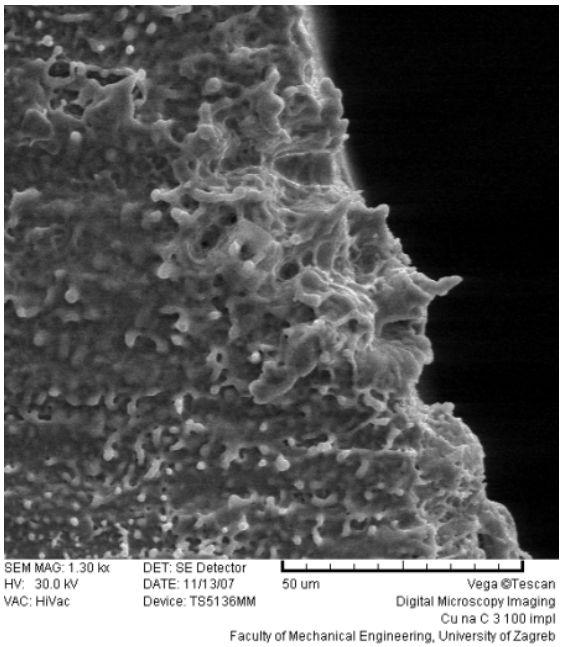

Figure 2. Edge of Cu target

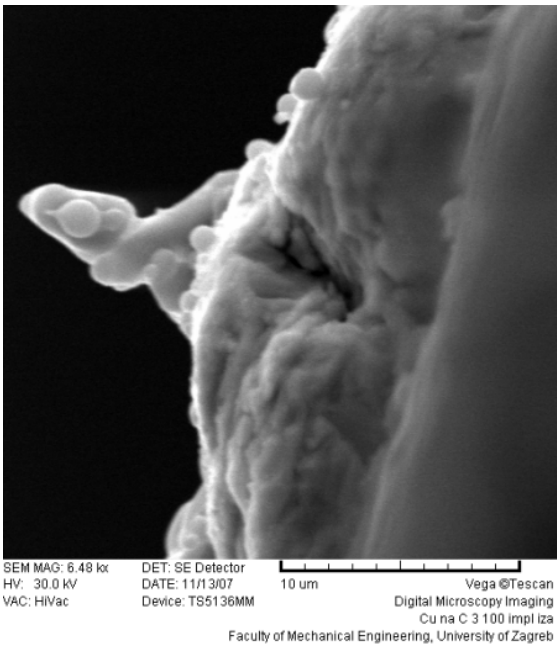

Figure 3. Reverse side of target

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