Publ. Obs. Astron. Belgrade No. 53 (1996), 33 *Invited lecture*

Приглашенный доклад

CRATER MORPHOLOGY INDUCED BY DIFFERENT ENERGETIC BEAMS

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Changes induced on solid surfaces and in solids during interactions of energetic beams depend on beam characteristic and target properties. Such interactions result in modification of material properties such as: surface sputtering/erosion, morphological changes and degradation of thermomechanical properties of bombarded solids. Synergetic erosion of materials exposed to the impact of complex interaction - different beam species, broad energy and angular distribution - differs from these obtained by well defined beams.

Interest in macroparticle beam induced modification of solids was stimulated by space research. Collisions of dust particles, micrometeorid, aerosol and electromagnetic radiations on space vehicles materials result in radiation damage of constructing materials. Fast dissipation energy on vehicle materials causes sputtering/erosion microcrater formations, free ion emission from the bombarded surfaces and as a consequence the degradation of material properties. Empirical knowledge has been collected but mechanism involved in the processes have not been completely explained.

The goal of our experiments was to obtain the information on the mechanism of erosion with different energetic beams. The energy deposited by different beams than ions can be compared with energy deposited by very high energy of the ion beam.

Target morphology, crater diameter and depth of damage have been determined by SEM analysis and by profiling the depth of the erosion using a profilometer. We have found that with impact velocities in the hyper velocity region - more than a few km/s - sputtering of target takes place with crater formation. For irregular microparticles the crater was detected for velocities above 0,5 km/s, while for low velocities reflection of particles was observed. For lower particle beam the erosion of the bombarded surface proceeds in two steps: formation of damage by some fraction of the energy as heat in certain region of the surface and by the expansion of material outside that region as a result of the flow. The results of the laser beam damage experiment are compared with results obtained by plasma particle interaction with the spacecraft.

Crater simulation experiments have not only contributed to the interpretation of crater morphologies; extrapolations from laboratory data may allow empirical calibration approach. It seems that by analyzing the similarities in behavior of the spacecraft material damage and behavior of the target during interaction with well defined beams - taking care on discrepancies resulting from different beam characteristics and surface conditions - some useful information for the analysis of the mechanism of vehicle material degradation can be obtained.