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TUNGSTEN AND ODS STEEL BEHAVIOR AT HIGH INTENSITY, 10^{15} W/cm^2, LASER IRRADIATION IN AIR AND VACUUM AMBIENCE: COMPARATIVE STUDY

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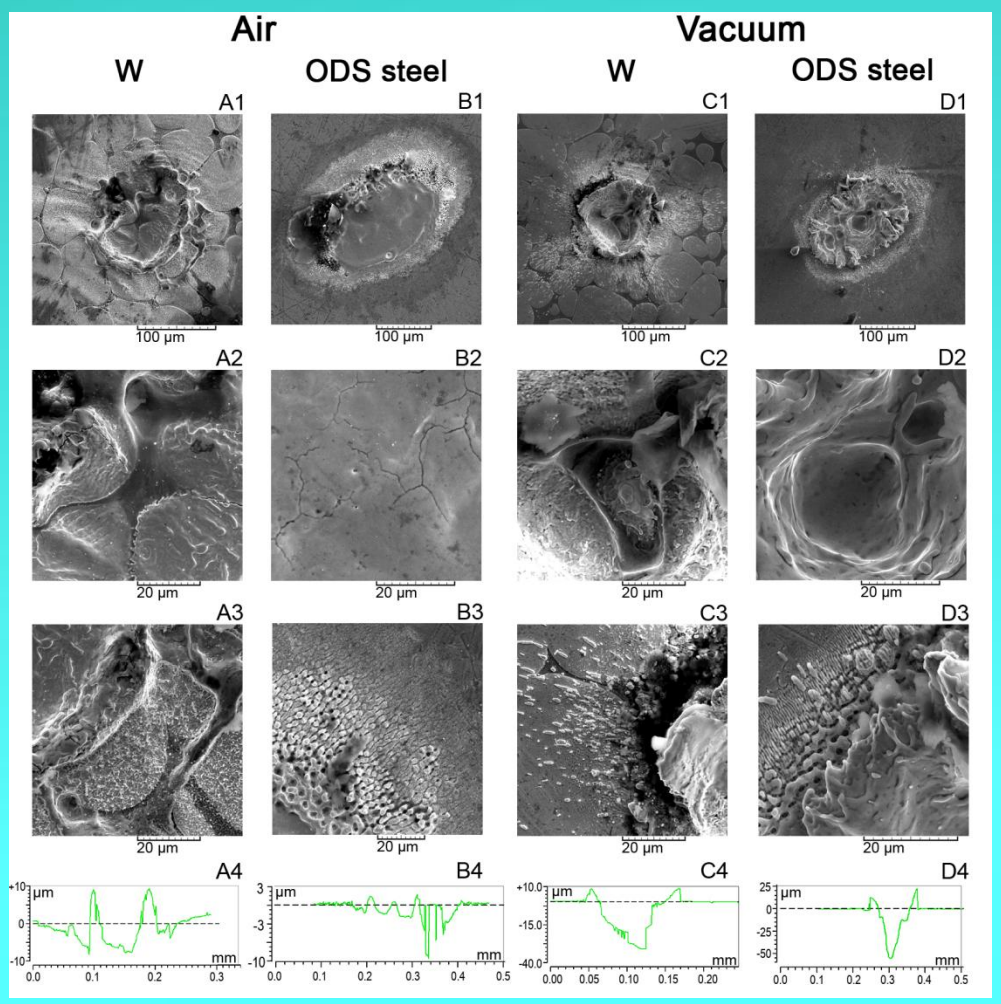
Abstract. *The effects of high intensity, 10^{15} W/cm^2, laser radiation on tungsten (W) and oxide dispersion-strengthened (ODS) steel in ambiences of air and vacuum were studied. In both samples and mediums high intensity laser radiation induced morphological and chemical variations. Surface features and phenomena depend on the material characteristics and the ambience applied. Thus, crater depth was larger in vacuum then in air for ODS steel sample - ~55 μm vs. ~9 μm. Irradiation was accompanied with the appearance of plasma which can emit X-ray radiation. Chemical surface changes, particularly oxidation, were registered as well.*

W and ODS steel have extraordinary characteristics attractive for various applications, including ***nuclear complex***. In inertial fusion (***IF***) reactor both metals are serious candidates for the ***First Wall Materials*** (FWM). FWMs are exposed to various fluxes like electromagnetic and thermal, thus the action of high intensity laser radiation can, in one approximation, simulate behavior of these materials inside the reactor.



Laser pulse energy of ~5.2 mJ, intensity **10^{15} W/cm^2** (100 pulses), induced distinguishing surface features and phenomena. Generally, they are in strong correlation with sample type and ambience:

(i) in both targets ***crater like damages*** were registered with crater depth larger in ODS steel, ~55 μm, vs. ~33 μm for W in vacuum. Also, damages were always more prominent in vacuum. In the peripheral area specific changes were registered such as hydrodynamic (***HD***) effects, laser-induced periodic surface structures (***LIPSS***);

(ii) irradiation was accompanied with the appearance of ***plasma*** which can emit x-ray radiation;

(iii) ***chemical surface changes***, particularly oxidation, were registered in air as well as in vacuum but only in ODS steel.

The results could contribute to better understanding of the behavior of nuclear reactor materials under high fluxes that can be simulated by laser intensities applied here.

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