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Laser Induced Ablation of Metals at Different Ambient Conditions: Experiments and Simulation[1] AHMED ELSIED, PAYSON DIEFFENBACH, PRASOON DIWAKAR, TATYANA SIZYUK, AHMED HASSANEIN, Purdue University, CENTER OF MATERIALS UNDER EXTREME CONDITIONS, SCHOOL OF NUCLEAR ENGINEERING, PURDUE UNIVERSITY TEAM —
Laser erosion of metals under different ambient conditions and laser fluences, has been studied using 1064 nm, 6 ns Nd:YAG laser on 1 mm thick W and Al. Experiments were designed to study the effect of various parameters (material properties, laser fluence, ambient gas, ambient pressure) on metal ablation. Using two different ambient gases (air and argon), the metals were ablated over wide range of incident laser fluence to study the effect of ambient gas on metal ablation. To quantify the ablation process, the crater profile was measured using White Light Profilometer which provided information regarding the amount of mass ablation crater shape, and melt formation. These measurements were used for comparing the ablation processes for various conditions. The study is supported by analytical models and computer simulation which shows strong agreement with the experimental data. The ablation yield has very consistent dependence on incident laser fluence. At low laser fluence, with respect to ablation threshold, this dependence is logarithmic while, at high laser fluence the ablation yield is linear function of incident laser fluence. Ambient pressure was found to be significant in ablation processes. Detailed mechanisms of these effects will be presented.

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