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**ON THE FATIGUE BEHAVIOR OF SLM Ti6Al4V
SPECIMENS: DIC AND FRACTOGRAPHIC STUDY**

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Additive technologies will bring a significant effect on the basic manufacturing principles in all industries. This new approach significantly increase production efficiency due to reducing material consumption and direct transfer of the 3D CAD model to the final item excluding intermediary stages. But additive manufacturing has critical disadvantages, among them are internal defects such as unfused zones and high surface roughness. These lead to the additional post-production activities and also drastically reduce fatigue properties of the structures. Nowadays the prospective treatment techniques are thermal treatment, hot isostatic pressing. The other methods that are not widely spread, but at the same time improve the material properties are ultrasonic impact treatment and processing using high energy irradiation (ion or electron beam, plasma flow), which directly effects the surface roughness and hardness.

The paper aims at the investigation of the effect of ultrasonic impact treatment and electron surface beam processing on the fatigue behavior of Ti6Al4V SLM specimen. The behavior of the specimen was characterized by means of in situ DIC technique and analysis of fracture surfaces observed using scanning electron microscope.

The Ti6Al4V items were manufactured by powder bed fusion technique. The initial blanks have the height of 70 mm (parallel to the building direction) and 10x10 mm cross-section. Then they were electro-discharge machined (EDM) to obtain specimens with continuous radius between ends with a thickness of ~2 mm which were then subjected to post-processing treatment. These final specimens in initial state and after two treatment types were subjected to cyclic loading under the frequency of 20 Hz in servo-hydraulic testing machine. Before the crack initiates the images for DIC processing were captured every 2000 cycles, but when the crack appear the image acquisition performs every 50 cycles. During the test it was obtained pair of specimen photos at minimum load in the cycle and at maximum load in the cycle – this pair then were processed using DIC in order to calculate the crack tip position and stress intensity factor using Williams approximation, strain at the crack tip and changes in specimen compliance during crack growth.

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