Laser Parameters Effects on Weld Beads

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Abstract
The main goal of this work is to modify the surface of Ti-5553 (a titanium alloy) samples. The superficial modification has been done with laser and the analysis of the effects of power and focal distance from the laser was the main objective.

Key words: Titanium, Laser Parameters, Weld Beads.

Introduction
This work’s main goal is to produce beads on titanium Ti-5553 (Ti-5Al-5V-5Mo-3Cr-0.5Fe) and Ti-6-4 (Ti-6Mo-4V) plates. The chosen titanium alloy can suffer hardening through fine precipitation of the α phase on the metastable β phase. This causes an increase of mechanical strength and elastic modulus. Different beads with different parameters, such as laser power, focal distance and the presence of an old and a new coverglass (used to protect the laser lenses) have been made inside a glovebox in order to control the atmosphere and prevent the oxidation of the titanium. This has been made in order to have a better knowledge of the machine parameters, what would make its operation easier.

Results and Discussion
Having made the beads, the samples have been prepared for metallography. Images and measurements from the fusion zones have been made with optical microscope as can be seen in Image 1 and in Chart 1. It has been possible to see that, the closer the distance between the last lens and the sample surface got to 41.85 mm and the greater the laser power, the larger the penetration from the bead.

![Image 1](image1.png)

Image 1. Picture of the bead cross section with a 42.85 mm focal distance and power of 450W.

Chart 1. Characteristics of the beads made with different laser powers and with old and new coverglasses.

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<tr>
<td>300</td>
<td>1206</td>
<td>2269</td>
<td>New</td>
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Conclusions
The results show that the greater the laser power, the larger the penetration and the width of the bead. The ideal distance between the last laser lens and the surface of the sample should be 41.85 mm in order to achieve the most deep keyhole, but due to and unexpected experimental error that could not be verified. The presence of the new coverglass had a positive effect on the increase of the penetration of the bead.

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