

# Effect of laser peening process on the mechanical behavior of Ti-6Al-4V

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## ABSTRACT

The object of this work was to investigate the effect of laser peening(LP) process on the mechanical behaviors of the engine blades manufactured by Ti-6Al-4V alloy, such as hardness, roughness, and fatigue characteristics.

## I. INTRODUCTION

LP is well known mechanical surface treatments like shot peening process. Many studies on LP have been already conducted in a few of nations including US. Although it has more benefits than classical treatments, it is not well known in the other nations because the processing cost is so high. Nowadays, as the aerospace industries and nuclear power plants are highly growing in Korea, the demands of LP will increase in the market. It is the beginning stage of research work about LP in Korea. This paper presents a determination of LP outline accomplished under the ND:YAG pulsed laser.

## II. Experiment

### A. Methods

LP drives a high amplitude shock wave into a material surface using a high energy pulsed laser. This process changes the stress field from tensile to compressive, pulsed laser irradiation on an ablative layer deposited on the specimen surface. The interaction between laser and the ablative layer creates the high pressure plasma which leads to plastic deformation.

### B. Procedures

The test conditions are summarized on Table 1.

Table 1 Condition of Laser Peening

Condition(mJ)	200	400	600	800
Intensity(GW/cm <sup>2</sup> )	2.55	5.09	7.64	10.19
Laser	Q-switched ND:YAG(1064nm)			
Pulse width	10nsec			
Repetition rate	10Hz			
Spot size	Approx. 1mm			
Coverage	400%			
Overlapping rate	Approx. 82%			

## C. Results

The next figures show the hardness and roughness of laser peened Ti-6Al-4V.

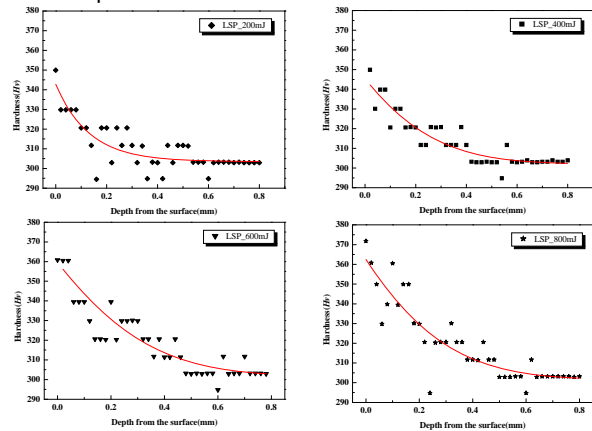


Fig. 1 Micro-hardness distribution by laser peening of Ti-6Al-4V cross section

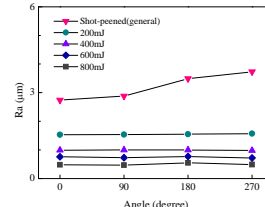


Fig. 2 Comparison of surface roughness SP and LP with various laser power

## III. Conclusions

As the laser power increases, the surface hardness and roughness were significantly changed. Higher laser power produced lower surface roughness. It seems that the surface material properties changed by LP can affect the mechanical behaviors, such as fatigue resistance of Ti-6Al-4V.

## REFERENCES

- Kevin K. Liu, Michael R. Hill, "The effects of laser peening and shot peening on fretting fatigue in Ti-6Al-4V coupons", Tribology International, Volume 42, Issue 9, pp. 1250-1262, 2009