Laser Surface Texturing for Improving Thermal Joint Strength Press-Fit Parts

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Abstract. In the manufacturing industry for structural components, the avoidance of brittle fracture is important. The surfaces of parts can undergo high thermal oxidation during or after production. Laser surface texturing can be optimized to avoid an oxide surface. Laser processing can also be used to increase the fatigue strength by increasing compressive residual stresses of parts. In this study the parameters and levels obtained adequate increase of diameter on parts were examined. The components obtained had high fatigue strength and to reduce thermal fracture stress in the surface. In this study the processing parameters and their responses such as length of HAZ and fatigue strength were studied to obtain increased part lifetime. The processing parameters resulted in a length of HAZ range from 0.06mm to 12.6mm and thermal fatigue tress between 1334N/m² to 1586188N/m² on the parts. The processing parameters such as transverse speed, laser power, and focal position were optimized to obtained a uniform surface roughness on the shaft and hub assembly on the steel material. The processing parameter of the overlap ratio was found to have a high correlation with the length of HAZ on the material. The processing parameters can be used to produce adequate melting and solidification for a crystalline microstructure production with high strength. The parts obtained can have applications in coatings and sealants that are exposed to wide temperatures of application. These parameters can be used to reduce processing times and costs in the design of the components.

Keywords: Additive manufacturing, Tensile strength, Surface texturing, Surface modification, Fracture strength, Interference Joints

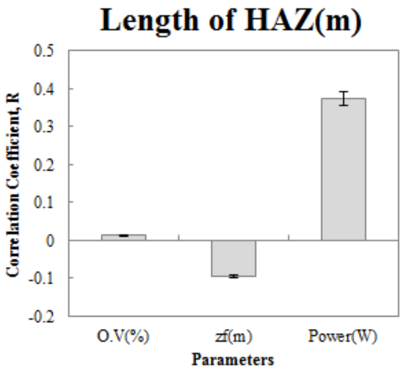

FIGURE 1. Effects of laser processing parameters for high constant power at 500W used to produce the HAZ formation on the samples.

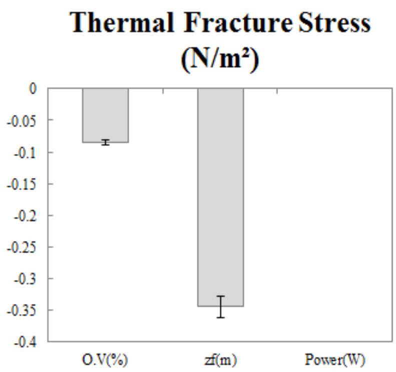

FIGURE 2. Effects of processing parameters for high constant power at 500W used to increase thermal fatigue strength of the joint.

TABLE 1. Laser surface treatment effects used that had HAZ on the samples.

O.V (%)	zf (m)	Power (W)	HAZ (m)	Thermal Fracture Stress (N/m^2)
-20	-1.5	500	0.0126	1027865
-20	0	500	0.00606	1197157
0	-1.5	500	0.0134	3196359
0	0	500	0.099	1919793
20	-1.5	500	0.0133	151132
20	0	500	0.0106	1334

TABLE 2. Laser surface treatment effects on reduction of HAZ on samples.

O.V (%)	zf (m)	Power (W)	HAZ (m)	Thermal Fracture Stress (N/m^2)
-20	1.5	500	0	153314
0	1.5	500	0	47246
20	1.5	500	0	1586188

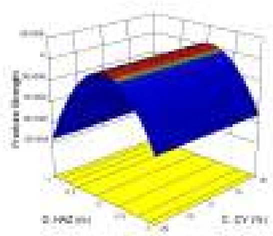

FIGURE 3. Surface plot showing relationship of focal position and HAZ to response of fracture strength of the samples

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