# Optimisation of Pulsed Nd: YAG Laser Processing of Gray Cast Iron for Enhanced Surface Properties

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**Abstract:** This paper presents laser surface modification of gray cast iron for enhanced surface hardness properties. A 300 W high power Nd:YAG laser system with pulse mode was used to modify gray cast iron samples surface. Laser processing was conducted using a $3^3$ full factorial design. Three controlled parameters were laser power, pulse duration and overlap percentage. The modified surface was characterised for metallographic study, roughness and hardness. Metallographic study and surface morphology were conducted using optical microscope while hardness properties were measured using Vickers scale. Surface roughness was measured using a 2D stylus profilometer. The results show that hardness of laser modified surface increased due to grain refinement. The overlapping rates increased significantly with decreasing laser scanning speed which affected sample surface integrity. Low surface roughness obtained at the highest scanning speed of 1400 mm/min, and low power of 830 W with pulse repetition frequency of 50 Hz. Process optimization was carried out for maximum surface hardness and laser modified depth, and minimum surface roughness. These findings indicate potential application of cast iron for high wear resistant applications through laser surface modification.

**Keywords:** Cast Iron, Laser Surface Modification, Nd:YAG Laser

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