Pulsed Nd:YAG Laser Surface Texturing of Pure Titanium Material

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Abstract Laser surface texturing is one of the key technologies in micromachining domain for generating defined surface features in micro-components in recent times. In this process, highly focused laser beam is irradiated on the material surface and laser scanning is carried out at different scanning patterns to alter surface conditions for improving the tribological properties of that surface. In this research study, an attempt has been made to carry out laser surface texturing on pure titanium material having a thickness of 1 mm with the aid of a pulsed Nd:YAG laser system. The various process parameters considered for the present research works are laser beam average power, pulse frequency, laser beam scanning speed, and transverse feed. Utilizing response surface methodology, experimentation has been planned. The responses measured are surface roughness, Ra and Rz in lateral and transverse directions and contact angle (θ). The chapter also highlights experimental results for validation of the developed empirical models. The test results have been analyzed using various surface plots. Multi-performance optimization has been conducted to obtain minimum values of surface roughness and contact angle. Using optical microscopic images, influence of process parameters on responses have also been discussed.

Keywords Laser surface texturing · Pulse Nd:YAG laser · Titanium Surface roughness · RSM · Optimization · Contact angle

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