Surface defects in groove milling of Hastelloy-C276 under fluid coolant

ABSTRACT

This study aims to investigate surface integrity in groove milling of Hastelloy-C276 using coated carbide end mills under the application of water-based fluid coolant using different cutting parameters. Surface integrity was assessed by measuring surface roughness, using focus variation microscope, and investigating surface defects, using scanning electron microscope. Micro-chips re-deposition and long grooves dominated the machined surface at low cutting speed (24–50 m/min). While cracked and fractured re-deposited materials, grooves, large debris, and plastic flow dominated the machined surface at high cutting speed (70–120 m/min), consequently surface roughness increased with cutting speed. Nucleated cavities appeared at all cutting speeds but with different densities. Shallow depth of cut at low cutting speed gave negative effect on surface roughness due to the effect of the hardened layer. Overall, the best surface finish, with average roughness below 50 nm and minimum surface abuse, was obtained in the speed range of 24–50 m/min at feed rate of 1 µm/tooth and depth of cut deeper than 0.1 mm.

Keyword: Defects; Deformation; Hardening; Machinability; Milling; Nickel; Roughness;

Surface