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Abstract

The paper deals with microhardness measurement up to a depth of 3 μm on hybrid metal matrix composite A359/ Al_2O_3/B_4C from the surface created by wire electric discharge turning and abrasive waterjet turning at the same of a range of rotational speed. The study also includes the topographical and morphological aspects of measurements to compare the surface quality. The microhardness was measured by Vickers indentation test at a load of 100g for 10s. Surface roughness profile parameters (Ra, Rq and Rz,) and 3D surface visualisation were measured by an optical profilometry. Laser confocal microscope was used to characterize the topographical details. FE-SEM analysis was used to discuss the morphological observations and to explore the quality and defects of the machined surfaces. The sub-surface element like residual stresses is also investigated through the depth profile for both types of turning process by means of XRD machine. The results showed that a lower value of microhardness (165HV) as compared to cast sample (200HV) has been observed in the recast layer of wire electrical discharge turning along with induction of tensile residual stress (340MPa). During abrasive water jet turning a nominal change in microhardness (204 HV) along with compressive residual stress (-285MPa) was observed.

Keywords: Microhardness, surface roughness, surface topography, surface morphology, residual stresses, abrasive water jet turning, wire electric discharge turning

Nomenclature

AWJ	– abrasive water jet
WED	– wire electric discharge
MMC	– metal matrix composite
d	– diameter (mm)
d_O	– water orifice (mm)
d_f	– focusing tube diameter (mm)
m_a	– abrasive mass flow rate (gm/min)
MRR	– material removal rate (mm^3/min)
n	– rotational speed (rpm)
p	– pressure (MPa)
Ra, Rq, Rz	– Surface roughness profile parameter (μm)
v	– traverse speed (mm/min)
z	– stand-off distance (mm)
ε	– residual strain (GPa)