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Experimental Study of the Effect of TiN–Zn Coated High-Speed Steel Cutting Tool on Surface Morphology of AL1060 Alloy During Machining Operation

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Abstract

In machining operations, surface morphology is a significant parameter in developing mechanical components, as the level of the surface roughness gives the consumer the notion of whether the product is well developed or not. Also, the surface roughness of the mechanical component will affect the component during machining operations. The application of coatings in cutting tools is very significant, as coatings will help in improving the cutting tool life as well as protect it from rapid wear and corrosion rate. This research work focuses on the investigation of the significance of TiN–Zn coatings on high-speed steel (HSS) when compared with non-coated HSS cutting tool on the surface morphology, machining parameters and machining time on 1060 aluminum alloy during the machining operation. Computer numerical control (CNC) program and excel software was employed to investigate the effects the Coated cutting tool, various depth of cut and such as 1, 1.5, 2, 2.5, and 3 mm and at a constant cutting speed of 1250 rpm, constant feed rate of 10 mm/rev, with machining time varies from 15 to 500 s on the machined surface morphology of the 1060 aluminum alloy. After each machining time, the average surface roughness was determined, from three-point of the work piece, that is the starting point, middle point, and the end point. The result shows that the TiN–Zn coated HSS cutting tool on the surface morphology of 1060 aluminum alloy was found to reduce surface roughness with about 15.5% and both minimum surface roughness of 0.96 and 1.06 μm was achieved for the TiN–Zn coated and uncoated HSS cutting tool, respectively, with cutting time of 15 s at 1 mm depth of cut, which is viable for machining operations.

Keywords

Coatings Machining Surface morphology Aluminum 1060 alloy HSS cutting tool

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