

Investigation of the tool wear and surface finish in low-speed milling of stainless steel under flood and mist lubrication

Abstract

This paper examines the performance of AlN/TiN coated carbide tool during milling of STAVAX® (modified AISI 420 stainless steel) at a low speed of 50 m/min under conventional flood and mist lubrication. Abrasion, chipping, fracture resulting in the formation of crater and catastrophic failure are the wear mechanisms encountered during machining under flood lubrication. The flank wear, and the likeliness of the cutting tool to fracture, chip and fail prematurely increased with an increase in the hardness of the workpiece and a reduction in the helix angle of the tool. Small quantity of mineral oil sprayed in mist form was effective in reducing the flank wear and severity of abrasion wear, and preventing the formation of crater and the occurrence of catastrophic failure. In milling 35 and 55 HRC-STAVAX® using a feed rate of 0.4 mm/tooth and a depth of cut of 0.2 mm under mist lubrication, the cutting edge of the 25° and 40° helix angle tools only suffered small-scale edge chipping and abrasive wear throughout the entire duration of testing. The influence of the ductility of the workpiece on the surface finish and the effectiveness of mist lubricant in improving the surface finish are also discussed