

## **Wear progression of carbide tool in low-speed end milling of stainless steel**

### **Abstract**

A study was undertaken to investigate the wear of PVD-coated carbide and uncoated carbide tools during milling of STAVAX (modified AISI 420 stainless steel) at low speeds. No significant change in the tool wear was observed when the cutting speed was increased from 25 to 50 m/min. It was found that increasing the hardness of the workpiece from 35 to 55 HRC caused a marked increase in the flank wear and a change in the dominant wear mechanism. In machining STAVAX with a hardness of 35 and 40 HRC, the coated tool was predominantly subjected to abrasive wear throughout the duration of testing. During machining STAVAX with a hardness of 55 HRC with the coated tool, three distinct stages of tool wear occurred, (i) initial wear by abrasion, followed by (ii) cracking and chipping, and (iii) the formation of individual surface fracture at the cracks which would then enlarge and coalesce to form a large fracture surface. The coated tool showed much higher fracture resistance than the uncoated tool. The high fracture resistance exhibited by the coated tool could be attributed to the effectiveness of the coating in preventing the formation of cracks which would act as preferential sites for fracture to take place. The experimental results also show that coating prevents edge chipping and enhances the abrasive wear resistance of the tool. Both the ductility of the workpiece and the tool wear appeared to have influences on the surface finish of the workpiece. It was found that the cutting fluid was effective in preventing catastrophic failure of the tool. © 2007 Elsevier B.V. All rights reserved.