

## Abstract

The aim of this study was to determine the effect of Ru and Mo ion implantation on the tool life of WC-Co straight grade cutting tool inserts during face milling of AISI H13 tool steel. The cutting tool inserts were implanted at 6 different ion implantation dosages. The acceleration voltage was kept constant for 5 ion implantation dosages at 100 keV and it was then increased to 120 keV for one of the ion implantation dosages. The face milling tests were conducted under unlubricated conditions according to ISO standard 8688-1: 1989. In order to ensure intermittent conditions the radial depth of cut was set at 30% of the cutter diameter. A 5 insert cutter was fully loaded during machining. The non-implanted inserts were used as the baseline for the volume of material to cut. The induced cutting forces of the ion implanted inserts were higher than that of non-implanted inserts due to increased shear area as a result of cutting edge chipping. The estimated heat generated when using ion implanted inserts had a scattered relationship with respect to the non-implanted inserts; this was attributed to the several factors involved in heat generation during machining. Several overlapping failure mechanisms were observed between the non-implanted and ion implanted inserts. The flank wear scar of the ion implanted inserts was smaller than that of non-implanted inserts indicating abrasion resistance from increased micro-hardness resistance. Even though the surface roughness of the machined components using ion implanted inserts was slightly higher than that of non-implanted inserts, it was still within allowable tolerances. Uncoated inserts failed prematurely due to workpiece adhesion that resulted to flaking and excessive chipping on the rake face. The ion implantation dosage of  $8\text{E}+15$  ions/cm<sup>2</sup> at 100 keV and  $2\text{E}+16$  ions/cm<sup>2</sup> at 120 keV were the best dosages with low wear rate, acceptable surface roughness and heat generation similar to that of non-implanted inserts.