

## ABSTRACT

The current work focus is machining performance of the coated tungsten carbide cutting tool by sandblasting pre-treatment. The main objective of this thesis is to investigate the effect of surface pre-treatment using sandblast on tungsten carbide (WC) cutting tool. The effect of machining performance on tungsten carbide cutting tool using this pre-treatment in term of wear rate also studied. The scope of work include tungsten carbide as cutting tool, silicon carbide for sandblast pre-treatment, PVD coating process and machining by turning operation. Tungsten carbide cutting tool was subjected to sandblast surface pre-treatment for 30 seconds before it was deposited with PVD coating process. Next, the cutting tool was test by turning machine in order to determine the wear resistant and other material characterization also was performed such as microstructure study, hardness Vickers test and surface roughness test. The current work result shows a smooth surface of the original tungsten carbide surface. After sandblasting pre-treatment, a coarse surface was developed onto tungsten carbide cutting carbide. Besides, the machining test performance shows the coated carbide with sandblasting surface pre-treatment provided longer tool's life compared to original tungsten carbide and coated tungsten carbide without pre-treatment cutting tools. In addition, the micro hardness test indicated that average Vickers micro hardness of original tungsten carbide specimen was 863.433 HV while coated carbide with sandblasting pre-treatment specimen was 1464.9 HV. In surface roughness test, the surface roughness of tungsten carbide increase after subjected to pre-treatment but decrease after undergoes coating process. From the result, the sandblasting surface pre-treatment and coating process affect the mechanical properties of tungsten carbide cutting tool such as microstructure, wear resistance, hardness and surface roughness.

## ABSTRAK

Kerja ini membentangkan kajian pengubahsuaian pada permukaan tungsten karbida dengan menggunakan semburan pasir sebagai pra-rawatan pada permukaan. Objektif utama tesis ini adalah untuk mengkaji kesan pra-rawatan menggunakan semburan pasir pada tungsten karbida (WC). Kesan prestasi alat pemotong tungsten karbida dengan menggunakan pra-rawatan ini diuji dengan mesin untuk melihat sejauh mana kadar jangka hayatnya dapat bertahan. Skop kerja termasuklah tungsten karbida sebagai alat pemotong, semburan pasir untuk pra-rawatan, proses salutan PVD dan proses pemesinan. Alat pemotong tungsten karbida disemur dengan silikon karbida selama 30 saat dan proses salutan PVD dilakukan. Alat pemotong tungsten karbida diuji dengan mesin untuk melihat kadar jangka hayatnya serta ujian lain seperti mikrostruktur, kekerasan dan kekasaran permukaan. Keputusan menunjukkan struktur biasa pada tungsten karbida asal manakala struktur yang kasar selepas pra-rawatan semburan pasir dilakukan. Selain itu, ujian dengan mesin menunjukkan tungsten karbida yang melalui pra-rawatan dan salutan mempunyai kadar jangka masa hayat yang tinggi berbanding tungsten karbida asal dan tungsten karbida tanpa pra-rawatan. Tambahan pula, ujian kekerasan Vickers bagi tungsten karbida asal ialah 863.433 HV manakala kekerasan tungsten karbida yang melalui pra-rawatan dan salutan ialah 1464.9 HV. Di dalam ujian kekasaran pula menunjukkan kekasaran permukaan bertambah selepas pra-rawatan semburan pasir tetapi berkurang selepas menjalani proses salutan. Daripada keputusan ini, ia menunjukkan bahawa pra-rawatan semburan pasir mempengaruhi tungsten karbida dari segi mikrostruktur, kadar jangka hayat, kekuatan dan kekasaran permukaan.