ABSTRACT

Over the decades machining of hard metals has always been a challenge in some manufacturing sectors. Hence, the introduction of the hybrid machining process was developed and research carried out in the area everywhere. Industry prefers manufacture of smaller as a part of development in every field. This research focuses on the micro machining of hard metals and investigates with the use of various designs of experiment techniques for material removal rate, diameter accuracy and surface roughness. In order to do this a rotary accessory setup is designed and fabricated to carry out the micro machining on hard and tough to machine materials.

The amount of wire deflection was analyzed with the designed numerical model and the variation was found within 2.5µm. For micro machining of high speed steel the spark gap with percentage contribution of 50% and spindle speed with percentage contribution of 24% have great influence on diametric accuracy. The spark gap with percentage contribution of 81% has a substantial influence on the material removal rate. For micro machining of tungsten, spindle speed is the most dominating parameter for diameter accuracy with a percentage contribution of 43.4%. The most dominating parameter for material removal rate is the spindle speed with a percentage contribution of 30.1%, and the second parameter is pulse off time with a percentage contribution of 28.4%.

Micro probes and micro tools manufactured in carbide can be used subsequently for further inspection and machining of micro components. The number of passes was the major factor in micro machining carbide for better diameter accuracy and surface roughness. Micro

components have been manufactured in this study and more can be produced as per requirements.

The addition of chemical mixture with the di-electric fluid is a very new concept and the same has been studied experimentally in this research for the effects on material removal and surface roughness. The addition of silver nitrate has seen a substantial improvement on the MRR and the surface finish values in WEDG process. There is a contribution of 60% reduction in Ra value and percentage contribution of 33.33% increase in MRR in the workpieces.

Micro drilling on titanium and molybdenum was carried out with the CNC EDM with the use of the manufactured micro electrodes. The optimal parameters for the wear rate of the electrodes have been found. Brass electrode cannot be used for micro drilling of molybdenum due to its high zinc content. The dominant factor affecting the wear of copper electrode is pulse on time with the percentage contribution of 45.59%. The dominant factor affecting the material removal rate for workpiece material (molybdenum) is pulse on time with the percentage contribution 40.54%.