

repeat any element twice and not to ignore any of these elements. By using matlab Simulink, a new program developed for machining time allowing the manufacturer to find rapidly the values of cutting time parameters and gives the management the opportunity to modify the processing parameters to achieve the optimum time by using the optimum cutting parameters.

[Paper ID554] INFLUENCE OF ELECTRODE COOLING ON MATERIAL MIGRATION AMONG THE ELECTRODES DURING EDM OF TITANIUM ALLOY

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ABSTRACT

Electrical discharge machining (EDM) is widely used in the machining of electrically conductive hard metals for the production of dies and moulds. This paper describes an investigation of the effect of electrode cooling on the amount of elements migration from the electrode to the workpiece surface and from the workpiece to the electrode surface. In the present study EDM has been performed with electrodes cooled by liquid nitrogen as well as with electrodes without cooling. Current, pulse-on time, pulse-off time and voltage were taken as the variables during conducting the experiments. The analysis on material migration during EDM was carried out by SEM and EDX. It was observed that EDM with liquid nitrogen reduces material migration and minimizes the surface contamination of both the electrodes.

[Paper ID555] THE CONDITION MONITORING OF THE MICRO V-GROOVING WITH A SINGLE CRYSTAL DIAMOND TOOL USING THE AE TECHNOLOGY

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ABSTRACT

This study deals with machining of micro V-grooves using a single crystal diamond tool that is implemented on a 3-axis micro-stage. A method for monitoring the machining conditions is investigated using acoustic emission (AE) signals in the micro-grooving. The AE signals and machined surface profiles are obtained in various the machining conditions. The signals are acquired from an AE sensor that is attached to the tool holder and are investigated to identify the correlation with the machined surface profiles. It is found that the AE signal is an effective parameter for monitoring the texture of machined surface.

[Paper ID557] SURFACE ROUGHNESS MODELS FOR END MILLING TITANIUM ALLOY Ti-6Al-4V UNDER ROOM TEMPERATURE AND PREHEATED MACHINING

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ABSTRACT

This paper presents an approach in developing the first and second-order surface roughness models at 95% confidence level for end milling of titanium alloy Ti-6Al-4V using PCD inserts. The surface roughness models developed were for room temperature machining and preheated experiments. The cutting parameters for room temperature machining were the cutting speed, axial depth of cut, and feed while those for preheated machining experiments were cutting speed, feed, and preheating temperature. Vertical Machining Centre (VMC) was used for conducting the end milling operations using PCD inserts. High frequency induction heating was utilized for preheated experiments. Surface roughness values were measured using a surface roughness measuring instrument Mitutoyo Surftest Model SV-500. Design expert package software was used to establish the surface roughness models and the adequacy of the models were verified using analysis of variance at 95% of confidence interval.

Surface roughness contours have been generated from these model equations and are shown in different plots. These models can be useful in computerized process planning and optimization.

✓ [Paper ID565] **SURFACE ROUGHNESS AND SURFACE INTEGRITY OF END MILLED TITANIUM ALLOY TI-6AL-4V AT ROOM TEMPERATURE AND PREHEATED MACHINING**

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ABSTRACT

This paper is concerned with the surface roughness and surface integrity of titanium alloy Ti-6Al-4V after end milling under room temperature and preheated conditions. End milling experiments were carried out on a Vertical Machining Centre, using 20 mm uncoated WC-Co inserts. High frequency induction heating was utilized for preheated experiments. Surface roughness values were measured using a surface roughness measuring instrument Mitutoyo Surftest Model SV-500. The surface integrity and subsurface alteration were investigated by employing scanning electron microscope and Vickers micro-hardness. Prior to surface integrity inspections, the sample was cut with electro discharge wire cutting, then mounted using hot mounting, ground using silicon carbide papers, polished with alumina solution, and then etched with 10% HF, 5% HNO₃ and 85% H₂O solutions. Microhardness was measured along the depth (perpendicular to the machined surface) at an interval of 0.01 mm starting from the top surface up and continued up to a depth of 0.5 mm. The results show that the surface layer could be divided into three zones, namely heat affected zone (Zone I), strain hardened zone (Zone II), and the base material (Zone III). A higher surface roughness achieved in preheated machining is attributed to the development of built-up edge (BUE) on the cutting tool surface.

[Paper ID571] **STUDY OF TOOL WEAR FOR MICRO-BALL-END MILLING PROCESS**

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ABSTRACT

Due to increase demand on the micro-meso component for miniaturized product, micromeso machining technique has gained strong interest in the past decade. Micro-ball-end-milling (MBEM) process can be used to generate complex curve surface and quickly remove work material with sufficient precision under low cost. However, tool wear decreases the machining efficiency and the process quality. Without effective control of tool wear, the process is not economical. Realizing the behavior of tool wear in an MBEM process is then critical. Concept of geometric sliding coefficient (GSC) defined as the fraction of tool-chip contacted area due to friction was proposed to describe the status of tool wear. Experiment was performed in the study to collect milling force data for the estimation of GSC. The GSC was found to be proportional to the measured tool flank wear (VB) under experimental conditions. Dimensionless analysis for GSC was also performed with two parameters, including machining conditions related parameter Km and time related parameter Kt. A mathematical relation with Kt and Km was thus constructed for the GSC such that GSC can be used as an effective reference for the status of tool wear of an MBEM process.

[Paper ID577] **APPLICATION OF DUCTILE FRACTURE CRITERIA TO INDUSTRIAL CUTTING PROCESSES**

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ABSTRACT

Experimental and numerical studies of fracture prediction with Czech steel no.41 2050 are presented. Seven ductile fracture criteria were calibrated, applied to simulation of rod cutting and bolt head trimming operation and compared with experimental results of these processes, obtained in semi-industrial conditions in cooperation with