

ABSTRAK

Wire Electrical Discharge Machining (WEDM) merupakan proses pemesinan non-konvensional yang menggunakan percikan listrik untuk mengikis material konduktif dengan tingkat presisi tinggi. Proses ini banyak digunakan dalam pembuatan komponen presisi seperti roda gigi lurus yang memiliki profil involute. Parameter pemesinan seperti *pulse on time* dan *feed rate* mempengaruhi kualitas hasil pemotongan dan efisiensi proses yang ditunjukkan oleh nilai profil involute dan *Material Removal Rate* (MRR). Penelitian ini bertujuan untuk mengetahui pengaruh *pulse on time* dan *feed rate* terhadap profil involute roda gigi lurus dan nilai MRR pada pemesinan WEDM material Aluminium 6061. Metode penelitian yang digunakan adalah metode eksperimen dengan variasi *pulse on time* sebesar 50 μ s, 75 μ s, dan 100 μ s serta *feed rate* sebesar 70 mm/min, 75 mm/min, dan 80 mm/min. Variabel terikat dalam penelitian ini adalah profil involute pada titik addendum dan dedendum serta *Material Removal Rate* (MRR). Pengukuran profil involute dilakukan menggunakan *Video Measuring Machine* (VMM), sedangkan MRR dihitung berdasarkan selisih massa benda kerja sebelum dan sesudah pemesinan terhadap waktu pemotongan. Data kemudian dianalisis menggunakan metode ANOVA untuk mengetahui pengaruh masing-masing parameter. Hasil penelitian menunjukkan bahwa *pulse on time* dan *feed rate* berpengaruh terhadap profil involute dan *Material Removal Rate* pada pemesinan WEDM Aluminium 6061. Kondisi pemesinan terbaik untuk profil involute diperoleh pada kombinasi *pulse on time* 75 μ s dan *feed rate* 75 mm/min dengan nilai addendum 112,791 dan dedendum 155,783. Sedangkan kondisi terburuk terjadi pada kombinasi *pulse on time* 50 μ s dan *feed rate* 70 mm/min dengan nilai addendum 117,521 dan dedendum 151,899. Nilai *Material Removal Rate* tertinggi diperoleh pada kombinasi *pulse on time* 50 μ s dan *feed rate* 80 mm/min sebesar 21,87 mm³/menit, sedangkan nilai *Material Removal Rate* terendah terjadi pada kombinasi *pulse on time* 100 μ s dan *feed rate* 70 mm/min sebesar 10,30 mm³/menit. Berdasarkan hasil penelitian dapat disimpulkan bahwa pemilihan kombinasi parameter *pulse on time* dan *feed rate* yang tepat sangat penting untuk memperoleh keseimbangan antara ketelitian profil involute dan efisiensi pemotongan pada proses WEDM material Aluminium 6061.

Kata kunci: Wire EDM, pulse on time, feed rate, profil involute, Material Removal Rate, Aluminium 6061.

ABSTRAC

Wire Electrical Discharge Machining (WEDM) is a non-conventional machining process that uses electrical discharges to erode conductive materials with high precision. This process is widely used in the manufacturing of precision components such as spur gears with involute profiles. Machining parameters such as pulse on time and feed rate influence the machining quality and process efficiency, which can be evaluated through involute profile accuracy and Material Removal Rate (MRR). This study aims to determine the effect of pulse on time and feed rate on the involute profile of spur gears and the MRR value in the WEDM process of Aluminium 6061 material. The research method used was an experimental method with variations of pulse on time of 50 μ s, 75 μ s, and 100 μ s and feed rate of 70 mm/min, 75 mm/min, and 80 mm/min. The dependent variables in this study were the involute profile at the addendum and dedendum and the Material Removal Rate (MRR). The involute profile was measured using a Video Measuring Machine (VMM), while the MRR was calculated based on the difference in the workpiece mass before and after machining divided by the machining time. The data were analyzed using ANOVA to determine the effect of each parameter. The results showed that pulse on time and feed rate affect the involute profile and Material Removal Rate in the WEDM process of Aluminium 6061. The best machining condition for the involute profile was obtained at a combination of pulse on time of 75 μ s and feed rate of 75 mm/min with addendum and dedendum values of 112.791 and 155.783, respectively. The worst condition occurred at a combination of pulse on time of 50 μ s and feed rate of 70 mm/min with addendum and dedendum values of 117.521 and 151.899. The highest MRR value was obtained at a combination of pulse on time of 50 μ s and feed rate of 80 mm/min with a value of 21.87 mm³/min, while the lowest MRR value occurred at a combination of pulse on time of 100 μ s and feed rate of 70 mm/min with a value of 10.30 mm³/min. Based on the results of this study, it can be concluded that selecting the appropriate combination of pulse on time and feed rate is important to achieve a balance between involute profile accuracy and machining efficiency in the WEDM process of Aluminium 6061.

Keywords: *Wire EDM, pulse on time, feed rate, involute profile, Material Removal Rate, Aluminium 6061.*