YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING, NAGPUR.

(An autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

DEPARTMENT OF MECHANICAL ENGINEERING

Parametric Optimization of Nickel-Titanium Based Shape Memory Alloy on Electro Discharge Machine

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Abstract:. Nickel-titanium-based shape memory alloy has been found to be hard also, therefore, it is very difficult to machine by using a traditional machining process hence non-traditional machining process is utilized Being the most versatile of all nonconventional machining, the electric discharge machining (EDM) process becomes viable for the machining of these hard-to-machine materials. The present study aimed to investigate the influence of input parameters such as pulse on time, current and flushing pressure on output responses of MRR and SR on nickel-titanium-based shape memory alloy.

Introduction:

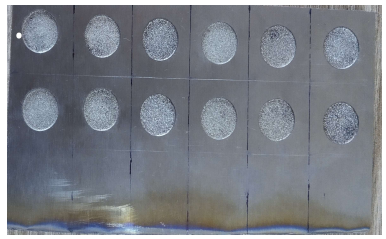
Shape memory alloys exhibit survival composition out of which nickel-titanium alloy became relatively popular for its biomedical application due to high corrosion and wear resistance, pseudo elasticity, and biocompatibility. Nickel-titanium-based shape memory alloy also found its application in various fields like automotive aerospace, and especially biomedical Nickel-titanium-based shape memory alloy is very difficult to machine hence EDM is utilized to machine this material. The process controls variables for getting the appropriate output values for the nickel-titanium-based shape memory alloy were quite uncertain. In order to achieve the appropriate output response, and support evaluating the efficacy of EDM, therefore it is crucial to tune the EDM process variables of nickel-titanium-based shape memory alloy.

Electrode Material:

Experiment Information

Machine –: Die Sinking EDM
Workpiece material –: Nickel-titanium-based shape memory alloy
Workpiece Dimension-: 100 mm X 50 mm X 5mm
Electrode material -: Copper
Electrode diameter-: 10mm
Process Variables -: Current, Pulse on time, and Flushing pressure.
Output response -: MRR, SR.

Machined Workpiece: Nickel-Titanium Based Shape Memory alloy



Experimentation Results:

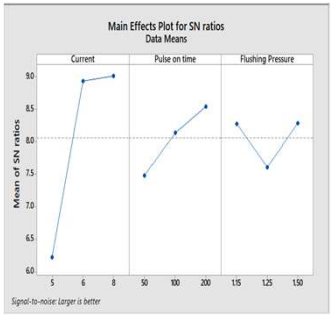
For MRR

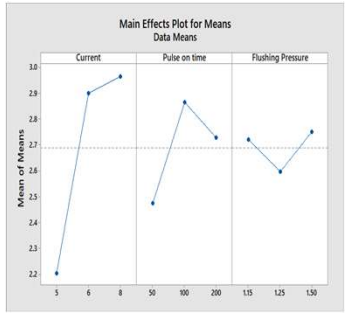
Response Table for Signal-to-Noise Ratios (largeer is better)

Level	Current	Pulse On time	Flushing Pressure
1	6.217	7.483	8.279
2	8.938	8.141	7.602
3	9.014	8.545	8.289
Delta	2.797	1.063	0.687
Rank	1	2	3

Response table for Mean(MRR)

Level	Current	Pulse On time	Flushing Pressure
1	2.205	2.476	2.722
2	2.899	2.864	2.598
3	2.965	2.730	2.750
Delta	0.759	0.389	0.153
Rank	1	2	3





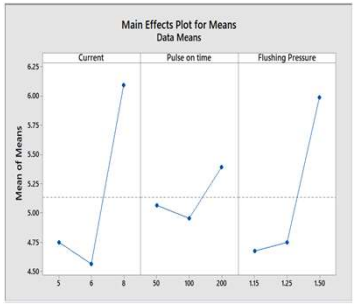
For SR

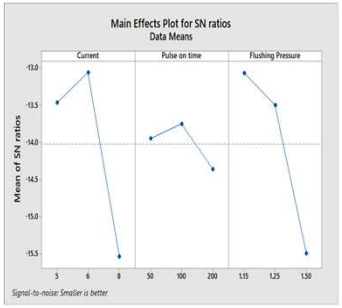
Response table for Mean(SR)

Level	Current	Pulse On time	Flushing Pressure
1	4.747	5.063	4.674
2	4.567	4.952	4.747
3	6.094	5.392	5.987
Delta	1.528	0.440	1.312
Rank	1	3	2

Response Table for Signal-to-Noise Ratios (smaller is better)

Level	Current	Pulse On time	Flushing Pressure
1	-13.47	-13.95	-13.07
2	-13.06	-13.76	-13.50
3	-15.54	-14.36	-15.50
Delta	2.48	0.60	2.43
Rank	1	3	2





Conclusion:

Current has the most impact on output responses out of all considered input parameters. Material removal rate increases with an increase in current. The current made a large impact on the material removal rate followed by pulse on time and flushing pressure. As the flushing pressure increases surface roughness is also increases The current made a large impact on the SR followed by flushing pressure and pulse on time.

Future Scope :

- The machined parameters can be optimized to gain more efficient results.
- Varied electrode materials like brass, tungsten etc can be studied to find the more suitable electrode for Nitinol SMA.

Sr.No	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3										3		3	
CO2	3			2		3				3				
CO3	3	3	3		3	3							3	3
CO4	3	3	3		3	3	3	3			3		3	3
CO5	3	3											3	
CO6	3		3	3	3		3	3			3		3	3
CO7	3				3	3								
CO8	3				3		3							
CO9	3											3		
Average														

Signature of Guide