

EDM performance characteristics and electrochemical corrosion analysis of Co-Cr alloy and duplex stainless steel: A comparative study

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Supplementary Tables

Table S1: Properties and specifications of workpiece materials.

Property	Co-Cr alloy	Duplex Stainless Steel
Chemical composition	Co:63.6%, Cr:28.5%, Mo:6%, Si:0.7%, Mn:0.5%, Ni:0.25%, C:0.22%, Fe:0.2%, Ti:0.01%, P:0.02%	Fe:66.93%, Cr:22.81%, Ni:5.2%, Mo:3.05%, Mn:1.43%, Si:0.5%, C:0.028%, P:0.03%, S:0.02%
Workpiece size (mm)	60 x 40 x 20	60 x 40 x 20
Density (g/cm ³)	8.3	7.8
Melting point (°C)	1330	1350
Thermal conductivity (W/mK)	9.4	19 at 100°C
Specific heat capacity (J/Kg°C)	390	418
Electrical resistivity (Ω cm)	6×10^{-6}	0.085×10^{-6}
Modulus of Elasticity (GPa)	216	200
Tensile Strength (MPa)	920	621
Rockwell Hardness (HRC)	34	31

Table S2: Properties and specifications of tool electrode.

Property	Graphite	Tungsten	Copper-Tungsten
Diameter (mm)	10	10	10
Density (g/cm ³)	2.26	18.8	14.5
Melting point (°C)	3650	3400	3410
Electrical resistivity (Ω cm)	6.0×10^{-3}	5.6×10^{-3}	4.5
Thermal conductivity (W/mK)	24	163.3	189
Thermal expansion coefficient ($\mu\text{m/mK}$)	6	4.5	11.7
Specific heat capacity (J/Kg°C)	720	133	214
Hardness (HB)	10	2570	195

Table S3: Machining variables and their values.

Variable	Description
Dielectric medium	EDM oil
Flushing pressure (kgf/cm ²)	0.6 (side flushing)
Current (A)	5, 10, 16
Pulse-on-time (μs)	60, 150, 200
Pulse-off-time (μs)	60, 150, 200
Electrode	Graphite, Tungsten, Copper-Tungsten
Polarity	Tool (+), Workpiece (–)

Table S4: Corrosion parameters evaluated by Tafel polarization curves.

Specimen alloy	E _{corr} (mV)	I _{corr} (μA/cm ²)	Corrosion rate (mm/year)	Polarization resistance (kΩ)
Untreated Co-Cr	-136.26	0.1812	0.0020251	386.680
Untreated DSS	-154.11	1.8112	0.19157	54.816
EDMed Co-Cr	-120.27	0.0351	0.000387	2677.4
EDMed DSS	-119.83	0.7215	0.007632	178.33