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# Mathematical modelling for recast layer in making of electric discharge machined rectangular channels on Al-$B_4C$ composite sintered preform

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## ABSTRACT

The Al-6wt.% $B_4C$ MMC was fabricated by a powder metallurgy route. The thoroughly mixed aluminum powder (25 mesh size) with $B_4C$ reinforcement particles (35µm average size) was cold compacted (cross-section of 30mm × 30mm) at 280MPa in the metallic die under 500kN capacity hydraulic press. The compacted green composite specimen was sintered in a tubular furnace under argon atmosphere. The theoretical and experimental density of the sintered MMC specimen were measured by a rule of mix and Archimedes principle respectively. The hardness ($H_V$) was measured by Vicker's micro-hardness test and the microstructure was studied under the optical and scanning electron microscope. The die-sinker EDM was performed to make rectangular channels at varied input experimental conditions based on Taguchi's experimental design (full factorial $3^3$=27 total runs). The three-levels of discharge current, *I* (4A, 6A, and 8A), discharge time, *t-on* (25µs, 45µs, and 65µs), and discharge idle time, *t-off* (24µs, 36µs, and 48µs) were considered as input variables. The average recast layer thickness, *ARLT* was considered as a response variable. The linear regression model was developed and the *ANOVA* was performed. The results showed that '*t-on'* is the significant parameter followed by *'I'* which effecting the recast layer formation and the reasons were discussed.

*Keywords: Metal Matrix Composite (MMC); Boron-carbide ($B_4C$); Powder metallurgy; Electric Discharge Machining (EDM); Crater; Recast-layer; Design Of Experiments (DOE); ANOVA.*
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