Silicon
https://doi.org/10.1007/s12633-019-00205-6

ORIGINAL PAPER

WEDM Parameter Optimization for Silicon@r-GO/Magneisum Composite Using Taguchi Based GRA Coupled PCA

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Received: 3 July 2018 / Accepted: 3 June 2019

Abstract
A combination of Taguchi methodology and Grey Relational Analysis (GRA) inturn coupled with principal component analysis (PCA) has been proposed through this paper. This methodology is adopted in order to evaluate and estimate the effect of machining parameters over the output responses of Wire Electrical-Discharge Machining (WEDM) performed on Magnesium based metal matrix composite. In this research, an optimal combination of process parameter was expected to be finalized so as to attain a state of maximum Material Removal Rate (MRR) that too with minimal surface roughness (Ra) value. WEDM of developed composite specimens were confirmed to be of L27 orthogonal array(OA) using Taguchi's method, based mainly on control factors namely reinforcement weight percentage (wt.%), Doping (DP %), Pulse ON time (T-ON), Pulse OFF time (T-OFF) and wire feed rate (WF). ANOVA outcome reveals that wt.% and DP% are the most influencing parameter for MRR and Ra. Multiobjective responses were normalized using GRA; further PCA was applied to evaluate the weighting values corresponding to each performance. The optimial parameter was set and the final results obtained depending on the optimal combination was found to be with a maximum MRR of 14.9 mm^3/min and a minimum Ra of 2.04 μm.

Keywords Magnesium · WEDM · Material removal rate · Surface roughness

1 Introduction

Rapid growth in modern business world accompanies with the growth of mechanical industries that demands for newer state of advanced materials that possess high hardness, impact and toughness. This fact instigates the investigators worldwide to focus them in the arena of progressive materials in order to satisfy the necessities of contemporary industries. Magnesium(Mg) and its alloys exhibits high strength to weight ratio; however, inferior wear and corrosion resistance limits their broader assortments and subjective applications thereof [1–4]. These overlays the way for development of composite material into which vital behaviour of selected material be obtained simply by addition of relevant reinforcement particles into their base matrix material. In general, base matrix material gets reinforced with harder ceramic particles viz. TiC,SiC,Zr etc., to upsurge its hardness; similarly solid lubricant component like graphite, boron nitride etc., shall be utilized for enhancement of its wear resistance [5–8].

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Published online: 01 July 2019