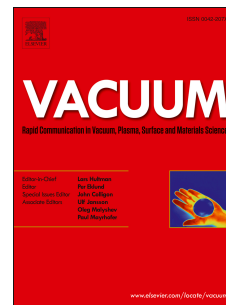


# Accepted Manuscript

Multi-objective particle swarm optimization of EDM parameters to deposit HA-coating on biodegradable Mg-alloy

Chander Prakash, Sunpreet Singh, Manjeet Singh, Kartikey Verma, Babulal Chaudhary, Subhash Singh



PII: S0042-207X(18)31255-7

DOI: [10.1016/j.vacuum.2018.09.050](https://doi.org/10.1016/j.vacuum.2018.09.050)

Reference: VAC 8263

To appear in: *Vacuum*

Received Date: 17 July 2018

Revised Date: 19 September 2018

Accepted Date: 25 September 2018

Please cite this article as: Prakash C, Singh S, Singh M, Verma K, Chaudhary B, Singh S, Multi-objective particle swarm optimization of EDM parameters to deposit HA-coating on biodegradable Mg-alloy, *Vacuum* (2018), doi: <https://doi.org/10.1016/j.vacuum.2018.09.050>.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Multi-objective particle swarm optimization of EDM parameters to deposit HA-coating  
on biodegradable Mg-alloy**

**Chander Prakash<sup>1</sup>, Sunpreet Singh<sup>1</sup>, Manjeet Singh<sup>1</sup>, Kartikey Verma<sup>2</sup>, Babulal  
Chaudhary<sup>3</sup>, Subhash Singh<sup>4\*</sup>**

<sup>1</sup>School of Mechanical Engineering, Lovely Professional University, Phagwara, Punjab- 144411,  
India

<sup>2</sup>Department of Chemical Engineering, Indian Institute of Technology, Kanpur-208016, India

<sup>3</sup>Indo-US Science and Technology Forum, New Delhi, India

<sup>4</sup>Department of Manufacturing Engineering, National Institute of Technology Jamshedpur,  
Jharkhand-831014, India

**ABSTRACT**

The present research work is aimed to discuss a novel method of depositing hydroxyapatite coats, with interconnected pores, on the surface of bio-degradable Mg-Zn-Mn alloy by using hydroxyapatite (HA) powder mixed electric discharge machining (HAM-EDM) process. The parameters of HAM-EDM process has been optimized using multi-objective particle swarm optimization (MO-PSO) technique to determine the optimal levels of concentration of hydroxyapatite powder ( $C_{HA}$ ), peak-current ( $I_p$ ), pulse-on ( $T_{on}$ ), and pulse-off ( $T_{off}$ ). The surface roughness ( $S_R$ ), thickness of recast layer ( $R_{LT}$ ), and micro-hardness ( $M_H$ ) were chosen as output response characteristics. The experiments were performed according to  $L_{27}$  orthogonal array and an empirical model has been developed to interpret the co-relation amongst input and output parameters. A number of optimal solutions (~100) were obtained by MO-PSO technique, where all responses were optimized. Among them, best optimal condition is to deposit biomimetic HA-containing layer with low SR (0.70  $\mu\text{m}$ ), low RLT (11.85  $\mu\text{m}$ ) and high MH (246 HV) was  $C_{HA} = 5.28$  g/l,  $I_p = 3.48$  A,  $T_{on} = 40.33$   $\mu\text{s}$ , and  $T_{off} = 109.29$   $\mu\text{s}$ . Further, the specimens produced were characterized, morphologically and topologically, and revealed the existence of hydroxyapatite (HA) layer with interconnected pores of 5-10 $\mu\text{m}$  size. The EDS spectrum showed that presence of Ca, P, and O on the modified surface, which conferred the deposition of HA-layer on the surface. The XRD pattern investigations of modified surface confirmed the

---

\*Corresponding author. Tel.: +91-9045704384  
E-mail address: [subh802004@gmail.com](mailto:subh802004@gmail.com) (S.Singh).

Download English Version:

<https://daneshyari.com/en/article/11026530>

Download Persian Version:

<https://daneshyari.com/article/11026530>

[Daneshyari.com](https://daneshyari.com)