PREFACE

Due to broad application in manufacturing sectors, wire electric discharge machining (WEDM) has become a widespread non-traditional method for machining of technically advanced materials. The process is also extensively used for versatile capability in making irregular through cutting geometry of hard and tough material like Ti6Al4V. In the thermal-assisted WEDM process, the surface of the machined area is greatly affected by transforming the surface morphology, i.e. crater, recast layer, and HAZ zone. But the critical importance based upon precision manufacturing; negative feedback is always reduced by implementing advanced techniques in the WEDM process. In terms of mixing powder particles in the dielectric, the performance efficiencies not only improve, but the WEDM process can also reduce the overall cost of production. Very few attempts were explored the machinability criteria of alloy by adding multiple powders with a dielectric in the WEDM process. Some reports are focused on the effect of different dielectrics in EDM as well as the WEDM process. In this study, the powder mixed wire EDM (PMWEDM) process is employed to enhance the machining ability, such as metal removal rate, surface topography, and dimensional accuracy (corner accuracy) of the tough alloys.

The contents of the thesis work have been presented through chapter 1 to 6 in a well designed manner. Chapter 1 outlines an overview of wire electric discharge machining processes, material removal mechanism, applications and technological parameters involve in this machining process. The new approach of powder mixed in dielectric along with working principle has been introduced. The role of dielectric and wire electrode along with their applications, are discussed in this chapter. Comprehensive evaluations of prior research are integrated and examined to identify the current gaps in knowledge, which are then emphasized in this chapter to define the research objectives.Chapter 2 explains the operational features of WEDM machine and experimental setup and measurement instruments used in the present set of research.

The impact of powders and dielectric has been discussed elaborately, and the problem statement has been highlighted in chapter 3. This chapter contains an overview for considering different powders and their properties used in the WEDM process. The influence of different dielectrics has been analyzed on the response measures such as material removal rate, surface roughness and dielectric consumption. Apart from this,

the hazard and operability (HAZOP) study is established for improving production quality, lower cost, safety process and pollution towards the environment during WEDM operation.

The parametric study and optimization of machining outputs in PMWEDM process have been explained in chapter 4. The influence of the control factors on the WEDM process performance has been studied through response surface methodology. After process modelling, multi-objective optimization, particle swarm optimization (PSO) coupled with the GRA approach, is also carried out to find out the optimized combinations of process parameters for achieving desired dimensional accuracy of PMWEDM. 3D and 2D topography of machining surfaces have been analyzed in the present investigation. The machined surface is examined through the scanning electron microscope.

Chapter 5 includes a comparative analysis of PMWEDM process parameters on the considered responses on Ti6Al4V material by PMWEDM process. The sensitivity analysis has been conducted to find out the most hazardous inputs which affect on WEDM outputs. The most influence of powder in dielectric during corner operation has been reported. SEM figures are also analyzed and highlighted an enhancement in machined surface geometry in the presence of powder in dielectric fluid. The corner accuracy in the WEDM process is compared with powder mixed WEDM in this chapter. In chapter 6, the general conclusions from the the present research work have been drawn in detail.

It is believed that the present research outcomes will provide a lot of knowledge to the elementary, practical researchers and production engineers for proper understanding of the numerous input variable influences along with new approach of powder mixed wire electrical discharge machining. The study also provides an appropriate direction and guideline to the manufacturing engineers for satisfying their present needs and precision manufacturing of intricate profiles for advanced manufacturing industries.