CHAPTER 5

DISCUSSIONS

5.1 Introduction

This chapter will discuss the data collected and analysed in the earlier chapters for the machining of DF2 tool steel using WEDM. Data are in the form of machine responses (surface roughness and material removal rate) and machining parameters (open circuit voltage – OV, pulse duration – ON, wire feed – WF, and flushing pressure – WA). Data are analysed using the Taguchi method and ANOVA.

5.2 Surface Roughness (R_a)

The experiment has shown how various factors have contributed towards the machining responses of surface roughness. From this experiment, it was observed that the wire feed rate (WF) and pulse duration (ON) have a significant contribution towards the surface roughness of DF2 with the contribution value of 24.15% and 22.34% respectively. Other factors like the open circuit voltage (OV) and dielectric flushing pressure have not significant effect towards surface roughness.

Using ANOVA, the machining response surface-roughness and machining parameters of WF and ON can be displayed in a 3D graph to show their relationship.

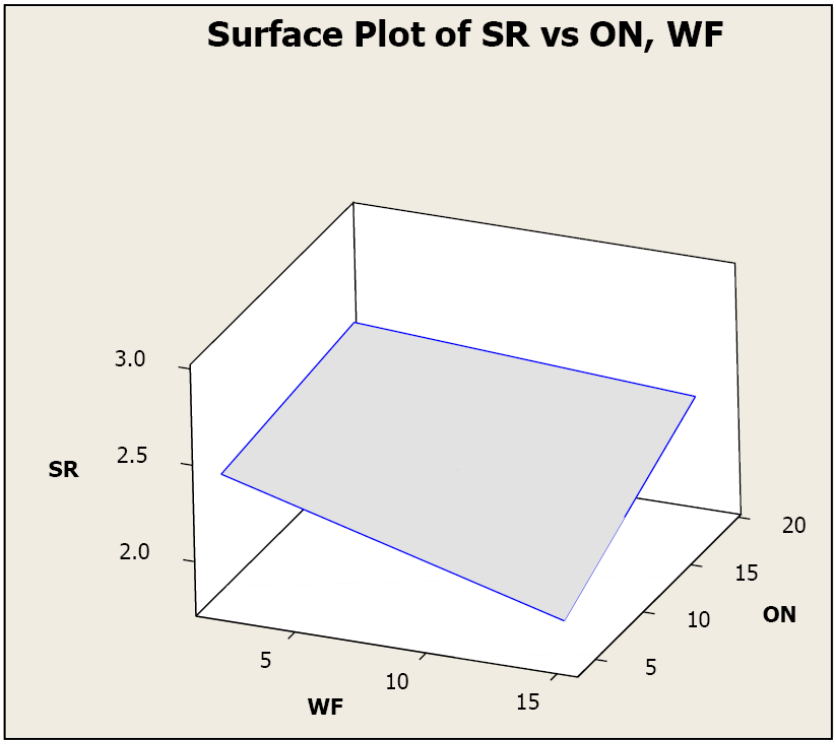

Figure 5.1: Surface Plot of Surface Roughness vs. ON, WF

From the analysis done on the data from the experiment, it was observed that the surface roughness value will increase by 13.17% when the machining parameter ON is set from low to high. Whereas, the surface roughness will increase by 13.41% when the machining parameter WF is set from high to low.

The finding of this project with regards to surface roughness is in-line with the study done by Ramakrishnan & Karunamoorthy (2008). They have have found that the wire feed rate plays a very significant role for allotting equal responses to the responses of material removal rate and surface roughness. Rao et al (2011) has found that pulse duration (ON) has significant effect on surface roughness due to the fact that the energy

content of a single spark discharge can cause surface irregularities due to much more melting and re-solidification of materials, and hence reducing the surface quality.

5.3 Material Removal Rate (MRR)

The experiment has shown how various factors have contributed towards the machining responses of material removal rate. From this experiment, it was observed that the pulse on duration (ON) and wire feed rate (WF) have a significant contribution towards the material removal rate of DF2 with the contribution value of 45.59% and 23.59% respectively. Other factors like the open circuit voltage (OV) and dielectric flushing pressure have not significant effect towards surface roughness.

Using ANOVA, the machining response of material removal rate and machining parameters of WF and ON can be displayed in a 3D graph to show their relationship.

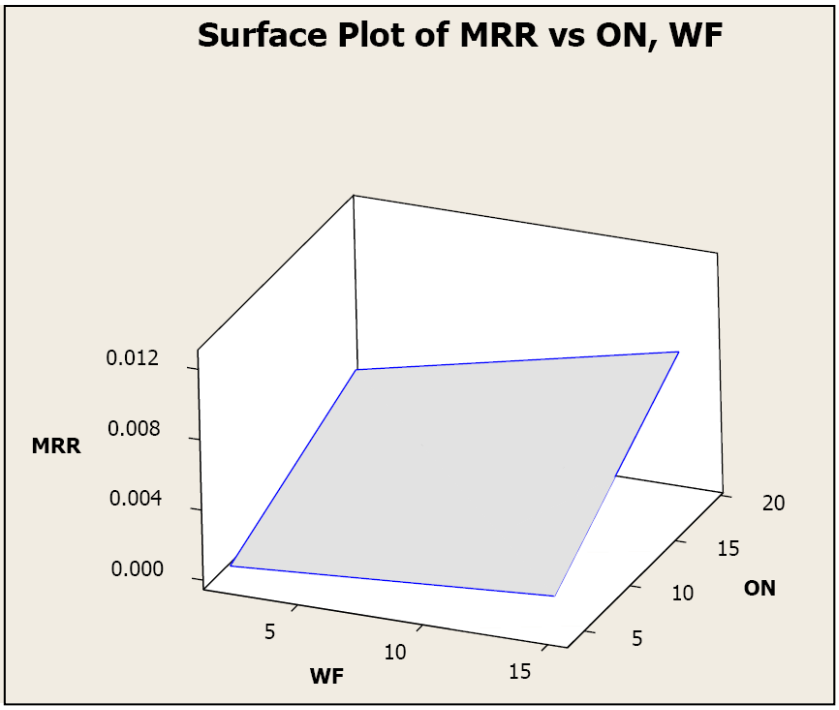

Figure 5.2: Surface Plot of MRR vs. ON, WF

From the analysis done on the data from the experiment, it was observed that the material removal rate will reduce by 82.27% when the machining parameter ON is set from high to low. Whereas, the material removal rate will reduce by 50.66% when the machining parameter WF is set from high to low.