(1) Variant parameter was Pulse Peak Current I_P (2 Amp, 6 Amp, 10 Amp,14 Amp) and Constant parameters were Mesh size of Sic= 300, Wt. % of Sic= 15%, T_{on} =70 µ sec, T_{off}= 7 µ sec, V_g =35 Volts. Machining was done and parameters were Measured Time Taken (min.), Tool Wear Rate (gm/min) and Metal Removal Rate (gm/min). The investigations of results are done graphically.
(2) Variant parameter was Gap voltage V_g (25 Volts, 30 Volts, 35 Volts and 40 Volts) and Constant parameters were Mesh size of Sic= 300, Wt. % of Sic= 15%, I_p =10amp, T_{on} =70 µ sec, T_{off}= 7 µ sec. Machining was done and parameters were Measured Time Taken (min.), Tool Wear Rate (gm/min) and Metal Removal Rate (gm/min). The investigations of results are done graphically.

3 RESULTS AND DISCUSION

3.1 Results and Graphs

All the experimental results are presented on graphs [from "fig.3.1 to 3.8"] as shown hereunder. In these graphs all measured parameters Tool Wear Rate (gm/min) and Metal Removal Rate (gm/min), Over cut (mm) and Surface roughness (µm)are taken on vertical axes, variant parameters Pulse Peak Current I_P (2 Amp, 6 Amp, 10 Amp,14 Amp) and gap voltage Vg (25 Volts, 30 Volts, 35 Volts and 40 Volts) are on horizontal axes and constant parameters are shown in box.

3.1.1 Effect of Pulse Peak Current on Performance Measures

The pulse peak current (I_P) was varied from 2 Amp to 14 Amp with the increment of 4 Amp. The Al/15 wt. % of SiC 300 mesh MMC as a workpiece material and copper electrodes were chosen for the experimentation. The values of pulse on time (T_{on}), pulse off time (T_{off}) and Gap voltage (V_g) were selected as 70 µ sec, 7 µ sec and 35 Volts respectively on machine control unit. Three holes were machined for each setting of pulse peak current values and performance parameters were measured as Tool Wear Rate, Metal Removal Rate,Over Cut on diameter and Average Surface Roughness. The calculated average values of three experiments for each performance parameters are given in table (iii)

Table. (iii) Effect of Pulse Peak Current on Performance Measures

Pulse Peak Current, I_P (Amp)	Tool Wear Rate (10^{-3}g/min)	Metal Removal Rate (10^{-3}g/min)	Over cut (mm)	Average Surface Roughness, R_a (µm)
2 Amp	2	23.4	0.123	4.445
6 Amp	2.19	35.8	0.153	4.564
10 Amp	2.22	45.8	0.21	4.586
14 Amp	2.45	68.2	0.29	4.626

The Figs 3.1 to 3.4 represent graphical investigation of results. It is observed that with the increase of pulse peak current (2 Amp, 6 Amp, 10 Amp and 14 Amp); Tool Wear Rate, Metal Removal Rate, Over cut and Average Surface Roughness R_a increases. Higher the current meant higher the energy dissipation at the sparking area hence less time was taken to machine the same size hole. Although MRR was increasing by increasing the current beyond 14 Amp but other machining performances were going in adverse direction. The MRR was very less at lower value of I_P. So the range of pulse peak current was selected as 6 Amp, 10 Amp and 14 Amp.

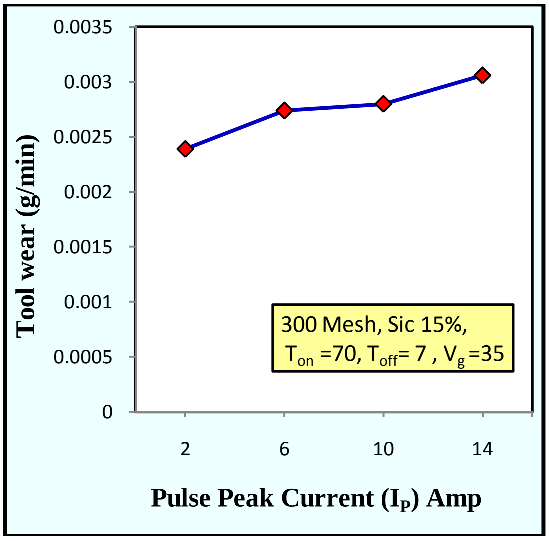

Fig. 3.1 Tool wear Vs Pulse Peak Current

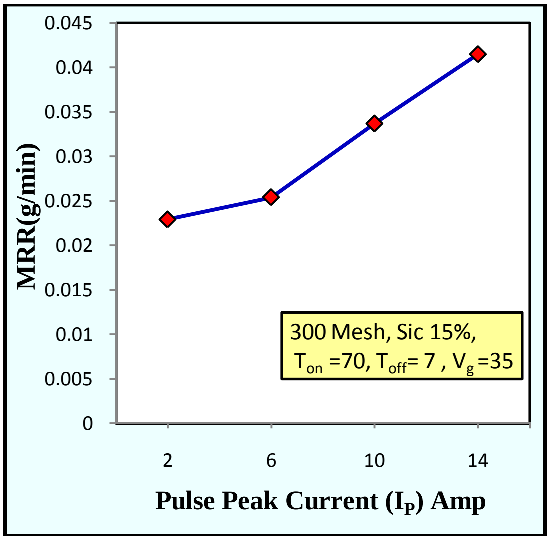

Fig. 3.2 MRR Vs Pulse Peak Current

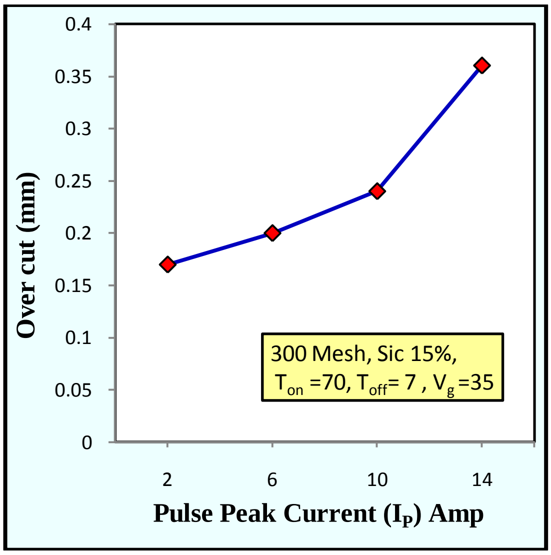

Fig. 3.3 Over cut Vs Pulse Peak Current

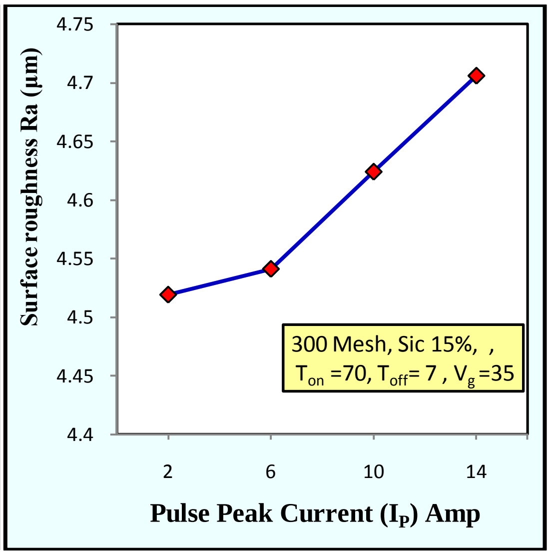

Fig. 3.4 Surface roughness Vs Pulse Peak Current

3.1.2 Effect of Gap Voltage on Performance Measures

The preliminary experiments were performed on EDM by varying the Gap voltage V_g from25 Volts to 40 Volts with the increment of 5 volts. The workpiece of size 35 mm diameter and 6 mm thick made of Al/15 wt. % of SiC 300 mesh MMC and copper electrodes were used for machining operation on EDM. The values of Pulse Peak Current, Pulse on time and Pulse off time were selected as 10 amp, 70 µ sec and 7 µ sec respectively. For each setting Machining was done three times with different gap voltage. Performance parameters measured were as Tool Wear Rate (g/min), Metal Removal Rate (g/min),Over cut on diameter (mm) and Average Surface Roughness R_a (µm). Calculated average values of machining performance parameters are shown in table. (iv)

Table . (iv) Effect of Gap voltage V_g on Performance Measures

Gap voltage, V_g (Volts)	Tool Wear Rate (10^{-3}g/min)	Metal Removal Rate (10^{-3}g/min)	Over cut (mm)	Average Surface Roughness, R_a (µm)
25 Volts	2.02	22.4	0.13	4.345
30 Volts	2.18	34.8	0.16	4.461
35 Volts	2.25	45.9	0.21	4.506
40 Volts	2.44	58.2	0.30	4.546

To explore the effects of gap voltage on performance parameters, the results were presented graphically as shown in Figs 3.5 to 3.8 respectively. With the increase of Gap voltage, Tool Wear Rate (g/min) increases with slow rate, Metal Removal Rate (g/min) increases with fast rate.

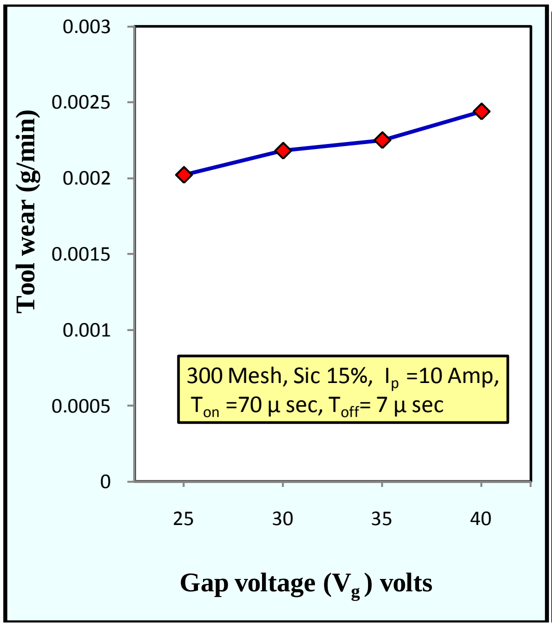

Fig. 3.5 Tool wear Vs Gap voltage

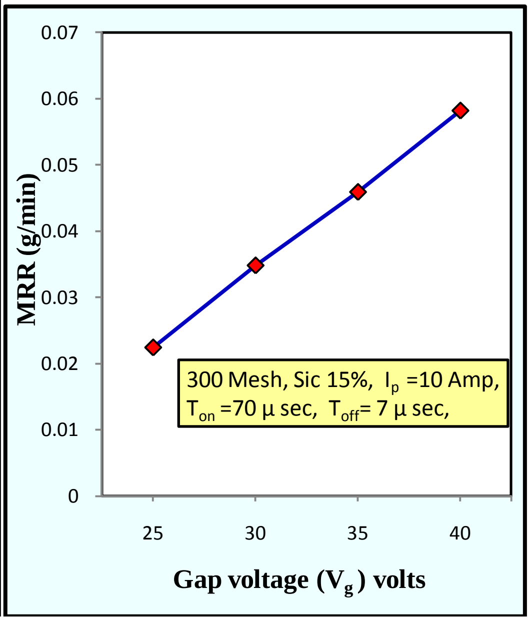

Fig. 3.6 MRR Vs Gap voltage

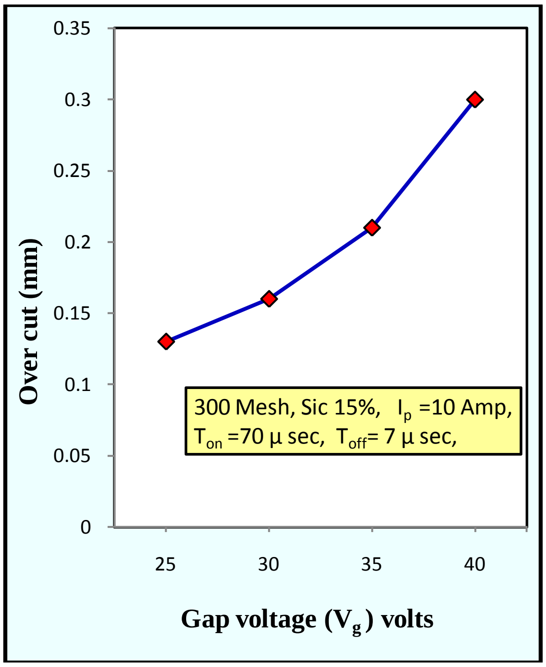

Fig. 3.7 Over cut Vs Gap voltage

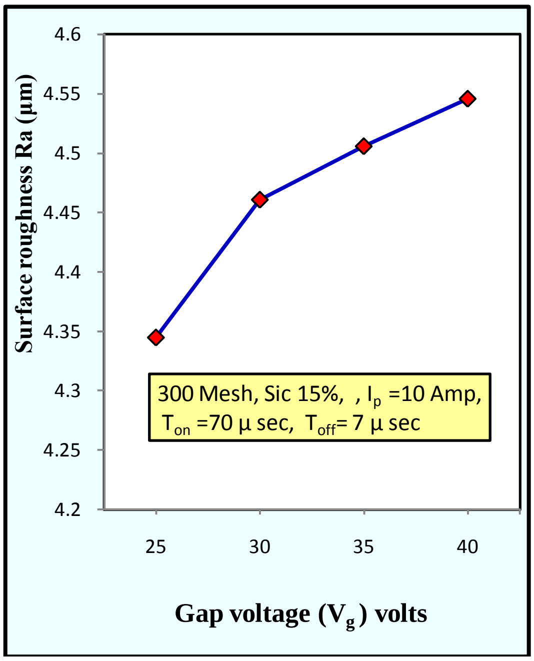

Fig. 3.8 Surface roughness Vs Gap voltage

Over cut (mm) and Average Surface Roughness R_a (µm) increases with moderate rate. Higher the gap voltage, higher the energy dissipated due to development of a strong electrostatic field between the electrodes. The dielectric medium break down at higher gap voltage and millions of electrons were developed in each spark. Because of higher energy sparks larger over cuts and larger chips were produced. Higher gap voltage was best suited for larger metal removal rate but played adverse role for tool wear rate, over cut and surface roughness. Although MRR was increasing by increasing the gap voltage beyond 40 volts but other machining performances were going in adverse direction. The MRR was very less at lower value of gap voltage. So the range of gap voltage was selected as 30 Volts, 35 Volts and 40 Volts.

4. CONCLUSION

- Performance parameters were increasing with the rising of pulse peak current. Maximum over cut was achieved at 14 Amp pulse peak current value during machining by EDM.
- The gap voltage is affecting all performance parameters (TWR, MRR, Over cut and Surface Roughness). Performance parameters were increasing with the increase in gap voltage.

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