|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Trial No.** | **Pressure**  **(bar)** | **Nozzle dia**  **(mm)** | **SoD (mm)** | **AFR (g/min)** | **Weight of nozzle**  **(g)** | **Job initial weight**  **Wi**  **(g)** | **Time**      **T**  **(sec)** | **Job final weight**  **Wf**  **(g)** | **Hole upper dia**  **(mm)** | **Hole bottom dia**  **(mm)** | **MRR (kg/s)** | **Kerf Taper in degrees** |
| 1 | 5.515 | 2 | 2 | 46.8 | 46.542 | 48.67 | 450 | 48.57 | 2.8 | 2.56 | 0.00023 | 3.43 |
| 2 | 5.515 | 2 | 2 | 46.8 | 46.542 | 48.57 | 450 | 48.46 | 2.76 | 2.46 | 0.00025 | 4.29 |
| 3 | 5.515 | 2 | 2 | 46.8 | 46.542 | 48.46 | 600 | 48.30 | 2.6 | 2.52 | 0.00026 | 1.15 |
| 4 | 5.515 | 2.5 | 3 | 283.8 | 38.571 | 51.46 | 330 | 51.23 | 4.52 | 2.78 | 0.00068 | 23.51 |
| 5 | 5.515 | 2.5 | 3 | 283.8 | 38.571 | 51.23 | 330 | 51.05 | 4.52 | 2.54 | 0.00057 | 26.34 |
| 6 | 5.515 | 2.5 | 3 | 283.8 | 38.49 | 51.05 | 330 | 50.87 | 4.42 | 1.78 | 0.00053 | 33.42 |
| 7 | 5.515 | 3 | 4 | 470 | 38.68 | 43.47 | 390 | 43.01 | 5.7 | 3.82 | 0.00118 | 25.17 |
| 8 | 5.515 | 3 | 4 | 470 | 38.68 | 43.01 | 390 | 42.60 | 5.6 | 3.72 | 0.00106 | 25.17 |
| 9 | 5.515 | 3 | 4 | 470 | 38.489 | 42.60 | 330 | 42.23 | 5.6 | 3.5 | 0.00111 | 27.70 |
| 10 | 6.5 | 2 | 3 | 470 | 46.542 | 44.10 | 480 | 43.91 | 3 | 2.9 | 0.00040 | 1.43 |
| 11 | 6.5 | 2 | 3 | 470 | 46.542 | 43.91 | 510 | 43.77 | 2.82 | 2.7 | 0.00029 | 1.72 |
| 12 | 6.5 | 2 | 3 | 470 | 46.542 | 43.77 | 510 | 43.61 | 2.8 | 2.6 | 0.00030 | 2.86 |
| 13 | 6.5 | 2.5 | 4 | 46.8 | 60.152 | 44.19 | 360 | 43.94 | 4.6 | 3.52 | 0.00069 | 15.11 |
| 14 | 6.5 | 2.5 | 4 | 46.8 | 60.152 | 43.94 | 360 | 43.69 | 4.52 | 3.12 | 0.00069 | 19.29 |
| 15 | 6.5 | 2.5 | 4 | 46.8 | 60.141 | 43.69 | 360 | 43.41 | 4.1 | 2.92 | 0.00078 | 16.44 |
| 16 | 6.5 | 3 | 2 | 283.8 | 38.675 | 35.85 | 360 | 35.44 | 5.38 | 4.1 | 0.00115 | 17.74 |
| 17 | 6.5 | 3 | 2 | 283.8 | 38.625 | 35.43 | 330 | 35.07 | 5.38 | 4.14 | 0.00112 | 17.22 |
| 18 | 6.5 | 3 | 2 | 283.8 | 38.55 | 35.07 | 300 | 34.74 | 5.36 | 3.54 | 0.0011 | 24.47 |
| 19 | 8 | 2 | 4 | 283.8 | 46.542 | 37.66 | 600 | 37.44 | 2.94 | 2.72 | 0.00036 | 3.15 |
| 20 | 8 | 2 | 4 | 283.8 | 46.542 | 37.44 | 600 | 37 | 2.92 | 2.86 | 0.00033 | 0.86 |
| 21 | 8 | 2 | 4 | 283.8 | 46.542 | 37.24 | 600 | 37.04 | 2.92 | 2.9 | 0.00035 | 0.29 |
| 22 | 8 | 2.5 | 2 | 470 | 38.251 | 43.67 | 330 | 43.36 | 5.04 | 3.82 | 0.00096 | 16.96 |
| 23 | 8 | 2.5 | 2 | 470 | 38.174 | 43.36 | 330 | 43.01 | 5.64 | 3.74 | 0.00105 | 25.41 |
| 24 | 8 | 2.5 | 2 | 470 | 38.14 | 43.01 | 330 | 42.71 | 5.82 | 3.24 | 0.0009 | 32.82 |
| 25 | 8 | 3 | 3 | 46.8 | 59.458 | 48.92 | 300 | 48.57 | 5.62 | 4.52 | 0.00117 | 15.38 |
| 26 | 8 | 3 | 3 | 46.8 | 59.458 | 48.57 | 300 | 48.24 | 5.38 | 4 | 0.00112 | 19.03 |
| 27 | 8 | 3 | 3 | 46.8 | 59.458 | 48.24 | 300 | 47.86 | 5.4 | 4 | 0.00127 | 19.29 |

Table 1. Results of Taguchi L27 orthogonal array trials in which abrasive jet impingement is carried out for random time period by keeping SoD constant.

Table 2. Results of Taguchi L27 orthogonal array trials in which abrasive jet impingement is carried out for time period (540 s, 600 s, 660 s) taken as control factor by keeping SoD constant.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trial No. | Pressure (bar) | Nozzle dia  (mm) | SoD (mm) | AFR (g/min) | Weight of nozzle | Job initial weight Wi | Time T | Job final weight Wf | Hole upper dia | Hole bottom dia | MRR (kg/s) | Kerf Taper in degrees |
|
|
| 1 | 5.515 | 2 | 2 | 46.8 | 51.25 | 85.683 | 540 | 85.548 | 2.6 | 2 | 0.00025 | 8.53 |
| 2 | 5.515 | 2 | 2 | 46.8 | 51.25 | 85.548 | 600 | 85.422 | 2.58 | 2 | 0.00021 | 8.25 |
| 3 | 5.515 | 2 | 2 | 46.8 | 51.25 | 85.422 | 660 | 85.291 | 3 | 2.7 | 0.000198 | 4.29 |
| 4 | 5.515 | 2.5 | 3 | 283.8 | 52.914 | 85.291 | 540 | 85.066 | 3.8 | 2.4 | 0.000417 | 19.29 |
| 5 | 5.515 | 2.5 | 3 | 283.8 | 52.914 | 85.066 | 600 | 84.826 | 3.8 | 2.7 | 0.0004 | 15.38 |
| 6 | 5.515 | 2.5 | 3 | 283.8 | 52.914 | 84.826 | 660 | 84.607 | 3.78 | 3.34 | 0.000332 | 6.28 |
| 7 | 5.515 | 3 | 4 | 470 | 50.149 | 84.607 | 540 | 84.242 | 4.42 | 3.76 | 0.000676 | 9.37 |
| 8 | 5.515 | 3 | 4 | 470 | 50.149 | 84.242 | 600 | 83.886 | 4.52 | 4.08 | 0.000593 | 6.28 |
| 9 | 5.515 | 3 | 4 | 470 | 50.149 | 83.886 | 660 | 83.492 | 4.42 | 4.04 | 0.000597 | 5.43 |
| 10 | 6.5 | 2 | 3 | 470 | 51.239 | 83.492 | 540 | 83.286 | 3.6 | 3 | 0.000381 | 8.53 |
| 11 | 6.5 | 2 | 3 | 470 | 51.239 | 83.286 | 600 | 83.106 | 3.4 | 2.42 | 0.0003 | 13.77 |
| 12 | 6.5 | 2 | 3 | 470 | 51.239 | 83.106 | 660 | 82.916 | 3.54 | 3.16 | 0.000288 | 5.43 |
| 13 | 6.5 | 2.5 | 4 | 46.8 | 52.919 | 82.916 | 540 | 82.595 | 4.14 | 3.6 | 0.000594 | 7.69 |
| 14 | 6.5 | 2.5 | 4 | 46.8 | 52.919 | 82.595 | 600 | 82.314 | 3.92 | 3.5 | 0.000468 | 5.99 |
| 15 | 6.5 | 2.5 | 4 | 46.8 | 52.919 | 82.314 | 660 | 82.009 | 4.26 | 3.72 | 0.000462 | 7.69 |
| 16 | 6.5 | 3 | 2 | 283.8 | 50.149 | 82.009 | 540 | 81.822 | 3.82 | 3.5 | 0.000346 | 4.57 |
| 17 | 6.5 | 3 | 2 | 283.8 | 50.149 | 81.822 | 600 | 81.568 | 3.9 | 3.68 | 0.000423 | 3.15 |
| 18 | 6.5 | 3 | 2 | 283.8 | 50.149 | 81.568 | 660 | 81.221 | 3.86 | 3.58 | 0.000526 | 4.00 |
| 19 | 8 | 2 | 4 | 283.8 | 51.239 | 81.221 | 540 | 81.05 | 3.14 | 2.86 | 0.000317 | 4.00 |
| 20 | 8 | 2 | 4 | 283.8 | 51.239 | 81.05 | 600 | 80.83 | 3.22 | 2.84 | 0.000367 | 5.43 |
| 21 | 8 | 2 | 4 | 283.8 | 51.239 | 80.83 | 660 | 80.616 | 3.44 | 1.76 | 0.000324 | 22.78 |
| 22 | 8 | 2.5 | 2 | 470 | 52.914 | 80.616 | 540 | 80.367 | 3.2 | 3 | 0.000461 | 2.86 |
| 23 | 8 | 2.5 | 2 | 470 | 52.914 | 80.367 | 600 | 79.905 | 3.22 | 3 | 0.00077 | 3.15 |
| 24 | 8 | 2.5 | 2 | 470 | 52.914 | 79.905 | 660 | 79.536 | 3.2 | 3 | 0.000559 | 2.86 |
| 25 | 8 | 3 | 3 | 46.8 | 50.149 | 79.536 | 540 | 79.236 | 4 | 3.2 | 0.000556 | 11.31 |
| 26 | 8 | 3 | 3 | 46.8 | 50.149 | 79.236 | 600 | 78.822 | 4.2 | 4 | 0.00069 | 2.86 |
| 27 | 8 | 3 | 3 | 46.8 | 50.149 | 78.822 | 660 | 78.501 | 4 | 3.62 | 0.000486 | 5.43 |

Table 3. Results of Taguchi L27 orthogonal array trials in which abrasive jet impingement is carried out for time period (540 s, 600 s, 660 s) taken as control factor by dynamic adjustment of SoD.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Trial No.** | **Pressure (bar)** | **Nozzle dia**  **(mm)** | **SoD (mm)** | **AFR (g/min)** | **Weight**  **of**  **nozzle**  **(g)** | **Job initial weight Wi (g)** | **Time**  **T**  **(sec)** | **Job**  **final weight Wf**  **(g)** | **Hole upper dia**  **(mm)** | **Hole bottom dia**  **(mm)** | **MRR (kg/s)** | **Kerf Taper**  **in degrees** |
|
|
| 1 | 5.515 | 2 | 2 | 46.8 | 51.289 | 44.49 | 540 | 44.35 | 2.8 | 2.74 | 0.00027 | 0.86 |
| 2 | 5.515 | 2 | 2 | 46.8 | 51.289 | 44.35 | 600 | 44.18 | 2.78 | 2.62 | 0.00028 | 2.29 |
| 3 | 5.515 | 2 | 2 | 46.8 | 51.289 | 44.18 | 660 | 44.05 | 2.92 | 2.82 | 0.00020 | 1.43 |
| 4 | 5.515 | 2.5 | 3 | 283.8 | 52.969 | 47.00 | 540 | 46.79 | 3.54 | 3.38 | 0.00038 | 2.29 |
| 5 | 5.515 | 2.5 | 3 | 283.8 | 52.969 | 46.79 | 600 | 46.61 | 3.58 | 3.5 | 0.00030 | 1.15 |
| 6 | 5.515 | 2.5 | 3 | 283.8 | 52.969 | 46.61 | 660 | 46.42 | 3.54 | 3.46 | 0.00030 | 1.15 |
| 7 | 5.515 | 3 | 4 | 470 | 50.042 | 78.42 | 540 | 78.12 | 4.48 | 3.9 | 0.00056 | 8.25 |
| 8 | 5.515 | 3 | 4 | 470 | 50.042 | 78.12 | 600 | 77.81 | 4.26 | 4 | 0.00051 | 3.72 |
| 9 | 5.515 | 3 | 4 | 470 | 50.042 | 77.81 | 660 | 77.50 | 4.3 | 4.06 | 0.00048 | 3.43 |
| 10 | 6.5 | 2 | 3 | 470 | 51.289 | 44.94 | 540 | 44.80 | 3.1 | 3.04 | 0.00027 | 0.86 |
| 11 | 6.5 | 2 | 3 | 470 | 51.289 | 44.80 | 600 | 44.65 | 3 | 2.78 | 0.00025 | 3.15 |
| 12 | 6.5 | 2 | 3 | 470 | 51.289 | 44.65 | 660 | 44.49 | 3.16 | 3.14 | 0.00023 | 0.29 |
| 13 | 6.5 | 2.5 | 4 | 46.8 | 52.969 | 43.72 | 540 | 43.46 | 3.8 | 3.72 | 0.00048 | 1.15 |
| 14 | 6.5 | 2.5 | 4 | 46.8 | 52.969 | 43.46 | 600 | 43.17 | 3.9 | 3.8 | 0.00049 | 1.43 |
| 15 | 6.5 | 2.5 | 4 | 46.8 | 52.969 | 43.17 | 660 | 42.86 | 3.9 | 3.78 | 0.00047 | 1.72 |
| 16 | 6.5 | 3 | 2 | 283.8 | 49.991 | 45.52 | 540 | 45.26 | 3.9 | 3.82 | 0.00047 | 1.15 |
| 17 | 6.5 | 3 | 2 | 283.8 | 49.991 | 45.26 | 600 | 45.02 | 3.82 | 3.74 | 0.00041 | 1.15 |
| 18 | 6.5 | 3 | 2 | 283.8 | 49.991 | 45.02 | 660 | 44.74 | 3.84 | 3.78 | 0.00042 | 0.86 |
| 19 | 8 | 2 | 4 | 283.8 | 51.289 | 45.74 | 540 | 45.50 | 3.3 | 3.2 | 0.00044 | 1.43 |
| 20 | 8 | 2 | 4 | 283.8 | 51.289 | 45.50 | 600 | 45.28 | 3.28 | 3.22 | 0.00037 | 0.86 |
| 21 | 8 | 2 | 4 | 283.8 | 51.289 | 45.28 | 660 | 45.04 | 3.3 | 3 | 0.00037 | 4.29 |
| 22 | 8 | 2.5 | 2 | 470 | 52.928 | 46.42 | 540 | 46.21 | 3.5 | 3.44 | 0.00038 | 0.86 |
| 23 | 8 | 2.5 | 2 | 470 | 52.928 | 46.21 | 600 | 45.95 | 3.5 | 3.46 | 0.00043 | 0.57 |
| 24 | 8 | 2.5 | 2 | 470 | 52.928 | 45.95 | 660 | 45.75 | 3.4 | 3.36 | 0.00032 | 0.57 |
| 25 | 8 | 3 | 3 | 46.8 | 49.991 | 44.73 | 540 | 44.14 | 4.1 | 4.06 | 0.00109 | 0.57 |
| 26 | 8 | 3 | 3 | 46.8 | 49.991 | 44.14 | 600 | 44.06 | 4.2 | 4.16 | 0.00013 | 0.57 |
| 27 | 8 | 3 | 3 | 46.8 | 49.991 | 44.06 | 660 | 43.74 | 4.2 | 4.08 | 0.00049 | 1.72 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Trial No.** | **Pressure**  **(bar)** | **Nozzle dia**  **(mm)** | **SoD (mm)** | **AFR (g/min)** | **Hole upper dia**  **(mm)**  **Cas1** | **Hole upper dia**  **(mm)**  **Case 2** | **Hole upper dia**  **(mm)**  **Case3** |
| 1 | 5.515 | 2 | 2 | 46.8 | 2.8 | 2.6 | 2.8 |
| 2 | 5.515 | 2 | 2 | 46.8 | 2.76 | 2.58 | 2.78 |
| 3 | 5.515 | 2 | 2 | 46.8 | 2.6 | 3 | 2.92 |
| 4 | 5.515 | 2.5 | 3 | 283.8 | 4.52 | 3.8 | 3.54 |
| 5 | 5.515 | 2.5 | 3 | 283.8 | 4.52 | 3.8 | 3.58 |
| 6 | 5.515 | 2.5 | 3 | 283.8 | 4.42 | 3.78 | 3.54 |
| 7 | 5.515 | 3 | 4 | 470 | 5.7 | 4.42 | 4.48 |
| 8 | 5.515 | 3 | 4 | 470 | 5.6 | 4.52 | 4.26 |
| 9 | 5.515 | 3 | 4 | 470 | 5.6 | 4.42 | 4.3 |
| 10 | 6.5 | 2 | 3 | 470 | 3 | 3.6 | 3.1 |
| 11 | 6.5 | 2 | 3 | 470 | 2.82 | 3.4 | 3 |
| 12 | 6.5 | 2 | 3 | 470 | 2.8 | 3.54 | 3.16 |
| 13 | 6.5 | 2.5 | 4 | 46.8 | 4.6 | 4.14 | 3.8 |
| 14 | 6.5 | 2.5 | 4 | 46.8 | 4.52 | 3.92 | 3.9 |
| 15 | 6.5 | 2.5 | 4 | 46.8 | 4.1 | 4.26 | 3.9 |
| 16 | 6.5 | 3 | 2 | 283.8 | 5.38 | 3.82 | 3.9 |
| 17 | 6.5 | 3 | 2 | 283.8 | 5.38 | 3.9 | 3.82 |
| 18 | 6.5 | 3 | 2 | 283.8 | 5.36 | 3.86 | 3.84 |
| 19 | 8 | 2 | 4 | 283.8 | 2.94 | 3.14 | 3.3 |
| 20 | 8 | 2 | 4 | 283.8 | 2.92 | 3.22 | 3.28 |
| 21 | 8 | 2 | 4 | 283.8 | 2.92 | 3.44 | 3.3 |
| 22 | 8 | 2.5 | 2 | 470 | 5.04 | 3.2 | 3.5 |
| 23 | 8 | 2.5 | 2 | 470 | 5.64 | 3.22 | 3.5 |
| 24 | 8 | 2.5 | 2 | 470 | 5.82 | 3.2 | 3.4 |
| 25 | 8 | 3 | 3 | 46.8 | 5.62 | 4 | 4.1 |
| 26 | 8 | 3 | 3 | 46.8 | 5.38 | 4.2 | 4.2 |
| 27 | 8 | 3 | 3 | 46.8 | 5.4 | 4 | 4.2 |

Table 1. Results of Taguchi L27 orthogonal array trials in which abrasive jet impingement is carried out for random time period by keeping SoD constant.