The statistical analysis (one-way ANOVA and Pearson’s correlation coefficient) for mechanical testing for toy brick tensile tester instrument was done using IBM SPSS Statistics for Windows Version 20.0 (IBM Corp., Armonk, NY) with α value set at 0.05.

1. **One-way ANOVA for uniaxial tensile test vs fracture stress and strain between toy brick tensile tester instrument and commercial mechanical testing instrument.**

Descriptive

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
| Lower Bound | Upper Bound |
| Fracture Strain | 1 | 5 | .1700 | .01871 | .00837 | .1468 | .1932 | .15 | .20 |
| 2 | 7 | .1143 | .04541 | .01716 | .0723 | .1563 | .05 | .18 |
| Total | 12 | .1375 | .04555 | .01315 | .1086 | .1664 | .05 | .20 |
| Fracture  Stress | 1 | 5 | 82.8960 | 65.21797 | 29.16636 | 1.9172 | 163.8748 | 42.29 | 198.63 |
| 2 | 7 | 97.0029 | 42.56558 | 16.08828 | 57.6363 | 136.3694 | 46.75 | 153.42 |
| Total | 12 | 91.1250 | 50.86965 | 14.68480 | 58.8040 | 123.4460 | 42.29 | 198.63 |

ANOVA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | Sum of Squares | df | Mean Square | F | Sig. |
| Fracture Stress | Between Groups | 580.427 | 1 | 580.427 | .208 | .658 |
| Within Groups | 27884.506 | 10 | 2788.451 |  |  |
| Total | 28464.932 | 11 |  |  |  |
| Fracture Strain | Between Groups | .009 | 1 | .009 | 6.574 | .028 |
| Within Groups | .014 | 10 | .001 |  |  |
| Total | .023 | 11 |  |  |  |

1. **One-way ANOVA for uniaxial tensile test vs fracture stress and strain between non-twisted uniaxial, twisted-clockwise uniaxial and twisted-anticlockwise uniaxial tests.**

Descriptive

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
| Lower Bound | Upper Bound |
| Fracture Strain | 2 | 7 | .1143 | .04541 | .01716 | .0723 | .1563 | .05 | .18 |
| 3 | 7 | .0943 | .04826 | .01824 | .0497 | .1389 | .06 | .20 |
| 4 | 8 | .1188 | .04051 | .01432 | .0849 | .1526 | .05 | .17 |
| Total | 22 | .1095 | .04380 | .00934 | .0901 | .1290 | .05 | .20 |
| Fracture Stress | 2 | 7 | 97.0029 | 42.56558 | 16.08828 | 57.6363 | 136.3694 | 46.75 | 153.42 |
| 3 | 7 | 54.5743 | 13.93656 | 5.26753 | 41.6851 | 67.4635 | 35.49 | 68.67 |
| 4 | 8 | 85.0713 | 30.90246 | 10.92567 | 59.2361 | 110.9064 | 37.12 | 125.94 |
| Total | 22 | 79.1641 | 34.81953 | 7.42355 | 63.7260 | 94.6022 | 35.49 | 153.42 |

ANOVA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | Sum of Squares | df | Mean Square | F | Sig. |
| Fracture Strain | Between Groups | .002 | 2 | .001 | .619 | .549 |
| Within Groups | .038 | 19 | .002 |  |  |
| Total | .040 | 21 |  |  |  |
| Fracture Stress | Between Groups | 6739.317 | 2 | 3369.658 | 3.420 | .054 |
| Within Groups | 18721.070 | 19 | 985.319 |  |  |
| Total | 25460.387 | 21 |  |  |  |

1. **One-way ANOVA for diameter vs fracture stress and strain.**

D1: Diameter less than 0.40 mm

D2: Diameter between 0.41-0.43 mm

D3: Diameter between 0.44-0.46 mm

D4: Diameter larger than 0.47 mm

Descriptive

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
| Lower Bound | Upper Bound |
| Fracture Strain | D1 | 4 | .1125 | .06292 | .03146 | .0124 | .2126 | .05 | .20 |
| D2 | 8 | .1025 | .02866 | .01013 | .0785 | .1265 | .08 | .16 |
| D3 | 8 | .1288 | .04357 | .01540 | .0923 | .1652 | .06 | .18 |
| D4 | 2 | .0550 | .00707 | .00500 | -.0085 | .1185 | .05 | .06 |
| Total | 22 | .1095 | .04380 | .00934 | .0901 | .1290 | .05 | .20 |
| Fracture Stress | D1 | 4 | 88.2200 | 30.48251 | 15.24125 | 39.7155 | 136.7245 | 60.62 | 125.94 |
| D2 | 8 | 80.5938 | 38.85641 | 13.73781 | 48.1090 | 113.0785 | 35.49 | 153.42 |
| D3 | 8 | 82.6025 | 35.42908 | 12.52607 | 52.9830 | 112.2220 | 37.12 | 134.78 |
| D4 | 2 | 41.5800 | 7.31148 | 5.17000 | -24.1111 | 107.2711 | 36.41 | 46.75 |
| Total | 22 | 79.1641 | 34.81953 | 7.42355 | 63.7260 | 94.6022 | 35.49 | 153.42 |

ANOVA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | Sum of Squares | df | Mean Square | F | Sig. |
| Fracture Strain | Between Groups | .009 | 3 | .003 | 1.809 | .182 |
| Within Groups | .031 | 18 | .002 |  |  |
| Total | .040 | 21 |  |  |  |
| Fracture Stress | Between Groups | 3264.098 | 3 | 1088.033 | .882 | .469 |
| Within Groups | 22196.289 | 18 | 1233.127 |  |  |
| Total | 25460.387 | 21 |  |  |  |

1. **Pearson’s correlation between diameter vs fracture stress and strain.**

Pearson’s Correlation Coefficient

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | diameter | | Fracture Stress | | Fracture Strain | |
| Diameter | Pearson Correlation | 1 | |  | |  | |
| Sig. (2-tailed) |  | |  | |  | |
| N | 22 | |  | |  | |
| Fracture Stress | Pearson Correlation | -.305 | | 1 | |  | |
| Sig. (2-tailed) | .167 | |  | |  | |
| N | 22 | | 22 | |  | |
| Fracture Strain | Pearson Correlation | -.056 | | .534\* | | 1 | |
| Sig. (2-tailed) | .805 | | .010 | |  | |
| N | 22 | | 22 | | 22 | |
| \*. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | |