

รายการอ้างอิง

ภาษาไทย

- เจน รัตนไพศาล. **ทันตวัสดุศาสตร์. พิมพ์ครั้งที่ 2.** กรุงเทพฯ: บริษัทโรงพิมพ์ไทยวัฒนาพานิช จำกัด, 2533.
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สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย



ภาคผนวก

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 1 time (1/1)	6	97172.1512	2211.294	902.757	
Mean Difference = 15885.7787					
Levene's Test for Equality of Variances: F= .054 P= .820					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	11.65	10	.000	1364.057	(11561.76, 20209.79)
Unequal	11.65	9.85	.000	1364.057	(11561.76, 20209.79)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 1 time (1/1)	6	.6648	.372	.152	
Mean Difference = 2.6323					
Levene's Test for Equality of Variances: F= .841 P= .381					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	7.40	10	.000	.356	(1.505, 3.760)
Unequal	7.40	7.12	.000	.356	(1.387, 3.877)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 1 time (1/1)	6	.0005	.000	.000

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Mean Difference = .0002

Levene's Test for Equality of Variances: F= 3.798 P= .080

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	1.58	10	.145	.000	(.000, .000)
Unequal	1.58	7.55	.155	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 1 time (1/1)	6	59.2833	3.982	1.626

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Mean Difference = 6.2000

Levene's Test for Equality of Variances: F= .159 P= .698

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	3.04	10	.012	2.038	(-.260, 12.660)
Unequal	3.04	9.31	.013	2.038	(-.424, 12.824)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean
TENSILE				
never cast before	6	113057.9298	2504.815	1022.586
cast 2 times (1/2)	5	83881.0068	5446.635	2435.809

Mean Difference = 29176.9230

Levene's Test for Equality of Variances: F= 4.391 P= .066

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	11.80	9	.000	2472.345	(21140.39, 37213.46)
Unequal	11.04	5.40	.000	2641.751	(18524.96, 39828.88)

Variable	Number of Cases	Mean	SD	SE of Mean
ELONGATE				
never cast before	6	3.2972	.788	.322
cast 2 times (1/2)	5	.3364	.394	.176

Mean Difference = 2.9608

Levene's Test for Equality of Variances: F= .564 P= .472

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	7.60	9	.000	.389	(1.695, 4.227)
Unequal	8.08	7.59	.000	.367	(1.730, 4.191)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 2 times (1/2)	5	.0003	.000	.000

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Mean Difference = .0004

Levene's Test for Equality of Variances: F= .953 P= .355

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	3.10	9	.013	.000	(.000, .001)
Unequal	3.17	8.99	.011	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 2 times (1/2)	5	61.5200	2.661	1.190

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Mean Difference = 3.9633

Levene's Test for Equality of Variances: F= .017 P= .898

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.29	9	.048	1.732	(-1.667, 9.593)
Unequal	2.32	8.94	.046	1.711	(-1.598, 9.524)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 3 times (1/3)	5	68288.8470	4966.893	2221.262	
Mean Difference = 44769.0828					
Levene's Test for Equality of Variances: F= 1.052 P= .332					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	19.45	9	.000	2301.816	(37286.87, 52251.30)
Unequal	18.31	5.67	.000	2445.340	(35700.73, 53837.44)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 3 times (1/3)	5	.5884	.595	.266	
Mean Difference = 2.7088					
Levene's Test for Equality of Variances: F= .152 P= .706					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	6.31	9	.000	.429	(1.314, 4.104)
Unequal	6.49	8.95	.000	.418	(1.351, 4.066)

Variable	Number of Cases	Mean	SD	SE of Mean
STRAIN				
never cast before	6	.0006	.000	.000
cast 3 times (1/3)	5	.0004	.000	.000

Mean Difference = .0002

Levene's Test for Equality of Variances: F= .049 P= .831

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	1.59	9	.145	.000	(.000, .001)
Unequal	1.58	8.17	.153	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
HARDNESS				
never cast before	6	65.4833	3.010	1.229
cast 3 times (1/3)	5	60.4600	2.485	1.111

Mean Difference = 5.0233

Levene's Test for Equality of Variances: F= .027 P= .872

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	2.97	9	.016	1.689	(-.466, 10.513)
Unequal	3.03	9.00	.014	1.657	(-.362, 10.409)

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 1 time (2/1)	5	94197.8644	1196.597	535.134	
Mean Difference = 18860.0654					
Levene's Test for Equality of Variances: F= 1.066 P= .329					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	15.34	9	.000	1229.388	(14863.85, 22856.28)
Unequal	16.34	7.42	.000	1154.145	(14820.15, 22899.99)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 1 time (2/1)	5	.8868	.817	.366	
Mean Difference = 2.4104					
Levene's Test for Equality of Variances: F= .031 P= .864					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	4.97	9	.001	.485	(.834, 3.987)
Unequal	4.95	8.51	.001	.487	(.828, 3.993)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 1 time (2/1)	5	.0002	.000	.000

Mean Difference = .0005

Levene's Test for Equality of Variances: F= 4.299 P= .068

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	4.50	9	.001	.000	(.000, .001)
Unequal	4.80	7.28	.002	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 1 time (2/1)	5	62.8600	2.387	1.068

Mean Difference = 2.6233

Levene's Test for Equality of Variances: F= .172 P= .688

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	1.57	9	.150	1.666	(-2.791, 8.038)
Unequal	1.61	8.99	.142	1.628	(-2.668, 7.915)

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean
TENSILE				
never cast before	6	113057.9298	2504.815	1022.586
cast 2 times (2/2)	5	84184.7076	4543.929	2032.107

Mean Difference = 28873.2222

Levene's Test for Equality of Variances: F= 2.734 P= .133

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	13.40	9	.000	2154.716	(21869.17, 35877.28)
Unequal	12.69	5.98	.000	2274.893	(20436.96, 37309.49)

Variable	Number of Cases	Mean	SD	SE of Mean
ELONGATE				
never cast before	6	3.2972	.788	.322
cast 2 times (2/2)	5	1.6880	.627	.280

Mean Difference = 1.6092

Levene's Test for Equality of Variances: F= .125 P= .731

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	3.69	9	.005	.436	(.190, 3.028)
Unequal	3.77	8.99	.004	.427	(.222, 2.996)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 2 times (2/2)	5	.0009	.001	.000

Mean Difference = -.0003

Levene's Test for Equality of Variances: $F = 4.324$ $P = .067$

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	-.61	9	.559	.000	(-.002, .001)
Unequal	-.55	4.28	.608	.001	(-.003, .002)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 2 times (2/2)	5	60.7000	2.483	1.110

Mean Difference = 4.7833

Levene's Test for Equality of Variances: $F = .093$ $P = .767$

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.83	9	.020	1.688	(-.705, 10.271)
Unequal	2.89	9	.018	1.656	(-.601, 10.167)

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 3 times (2/3)	6	67084.1785	9940.854	4058.337	
Mean Difference = 45973.7513					
Levene's Test for Equality of Variances: F= 30.013 P= .000					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	10.98	10	.000	4185.186	(32706.86, 59240.64)
Unequal	10.98	5.63	.000	4185.186	(30453.32, 61494.18)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 3 times (2/3)	6	1.5585	1.352	.552	
Mean Difference = 1.7387					
Levene's Test for Equality of Variances: F= 7.261 P= .023					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	2.72	10	.022	.639	(-.286, 3.764)
Unequal	2.72	8.04	.026	.639	(-.405, 3.883)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 3 times (2/3)	4	.0003	.000	.000

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Mean Difference = .0004

Levene's Test for Equality of Variances: F= .076 P= .790

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.51	8	.036	.000	(.000, .001)
Unequal	2.51	6.59	.042	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 3 times (2/3)	6	64.5500	2.611	1.066

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Mean Difference = .9333

Levene's Test for Equality of Variances: F= .020 P= .892

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	.57	10	.579	1.627	(-4.223, 6.090)
Unequal	.57	9.80	.579	1.627	(-4.223, 6.090)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 1 time (3/1)	6	96183.0272	4633.460	1891.602	
Mean Difference = 16874.9027					
Levene's Test for Equality of Variances: F= .714 P= .418					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	7.85	10	.000	2150.312	(10058.49, 23691.32)
Unequal	7.85	7.69	.000	2150.312	(9658.069, 24091.74)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 1 time (3/1)	6	1.1752	.505	.206	
Mean Difference = 2.1220					
Levene's Test for Equality of Variances: F= .157 P= .701					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	5.56	10	.000	.382	(.911, 3.333)
Unequal	5.56	8.51	.000	.382	(.880, 3.364)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 1 time (3/1)	6	.0007	.001	.000

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Mean Difference = -.0001

Levene's Test for Equality of Variances: F= 10.402 P= .009

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	-.34	10	.741	.000	(-.001, .001)
Unequal	-.34	6.59	.744	.000	(-.001, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 1 time (3/1)	6	57.3000	2.991	1.221

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Mean Difference = 8.1833

Levene's Test for Equality of Variances: F= .000 P= .988

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	4.72	10	.001	1.732	(2.692, 13.675)
Unequal	4.72	10	.001	1.732	(2.692, 13.675)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean
TENSILE				
never cast before	6	113057.9298	2504.815	1022.586
cast 2 times (3/2)	5	86134.8172	5191.101	2321.531

Mean Difference = 26923.1126

Levene's Test for Equality of Variances: F= 1.960 P= .195

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	11.31	9	.000	2381.072	(19183.27, 34662.96)
Unequal	10.61	5.54	.000	2536.767	(17515.71, 36330.52)

Variable	Number of Cases	Mean	SD	SE of Mean
ELONGATE				
never cast before	6	3.2972	.788	.322
cast 2 times (3/2)	5	1.1502	.915	.409

Mean Difference = 2.1470

Levene's Test for Equality of Variances: F= .568 P= .470

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	4.19	9	.002	.513	(.480, 3.814)
Unequal	4.13	8.02	.003	.520	(.400, 3.894)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 2 times (3/2)	5	.0003	.000	.000

Mean Difference = .0004

Levene's Test for Equality of Variances: F= 1.012 P= .341

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.94	9	.017	.000	(.000, .001)
Unequal	3.03	8.86	.014	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 2 times (3/2)	5	55.3200	2.924	1.307

Mean Difference = 10.1633

Levene's Test for Equality of Variances: F= .008 P= .929

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	5.65	9	.000	1.800	(4.313, 16.013)
Unequal	5.66	8.74	.000	1.794	(4.331, 15.996)

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean
TENSILE				
never cast before	6	113057.9298	2504.815	1022.586
cast 3 times (3/3)	6	78793.9705	7485.648	3056.003

Mean Difference = 34263.9593

Levene's Test for Equality of Variances: F= 20.396 P= .001

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	10.63	10	.000	3222.551	(24048.58, 44479.33)
Unequal	10.63	6.11	.000	3222.551	(22313.38, 46214.54)

Variable	Number of Cases	Mean	SD	SE of Mean
ELONGATE				
never cast before	6	3.2972	.788	.322
cast 3 times (3/3)	6	2.0587	1.174	.479

Mean Difference = 1.2385

Levene's Test for Equality of Variances: F= 1.443 P= .257

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	2.15	10	.057	.577	(-.591, 3.068)
Unequal	2.15	8.74	.061	.577	(-.638, 3.115)

Variable	Number of Cases	Mean	SD	SE of Mean
STRAIN				
never cast before	6	.0006	.000	.000
cast 3 times (3/3)	6	.0032	.004	.002

Mean Difference = -.0026

Levene's Test for Equality of Variances: F= 4.523 P= .059

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	-1.67	10	.125	.002	(-.007, .002)
Unequal	-1.67	5.04	.155	.002	(-.009, .004)

Variable	Number of Cases	Mean	SD	SE of Mean
HARDNESS				
never cast before	6	65.4833	3.010	1.229
cast 3 times (3/3)	6	63.6500	3.626	1.480

Mean Difference = 1.8333

Levene's Test for Equality of Variances: F= .285 P= .605

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	.95	10	.363	1.924	(-4.265, 7.932)
Unequal	.95	9.67	.364	1.924	(-4.265, 7.932)

t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean
TENSILE				
never cast before	6	113057.9298	2504.815	1022.586
cast 1 time (4/1)	6	119150.4150	4329.762	1767.618

Mean Difference = -6092.4852

Levene's Test for Equality of Variances: F= .747 P= .408

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	-2.98	10	.014	2042.096	(-12565.9, 380.888)
Unequal	-2.98	8.01	.017	2042.096	(-12946.1, 761.156)

Variable	Number of Cases	Mean	SD	SE of Mean
ELONGATE				
never cast before	6	3.2972	.788	.322
cast 1 time (4/1)	6	2.7998	.592	.242

Mean Difference = .4973

Levene's Test for Equality of Variances: F= .167 P= .691

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	1.24	10	.245	.402	(-.778, 1.772)
Unequal	1.24	9.28	.247	.402	(-.810, 1.805)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 1 time (4/1)	6	.0004	.000	.000

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Mean Difference = .0002

Levene's Test for Equality of Variances: F= .607 P= .454

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	1.75	10	.111	.000	(.000, .001)
Unequal	1.75	9.91	.112	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 1 time (4/1)	6	61.7000	3.775	1.541

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Mean Difference = 3.7833

Levene's Test for Equality of Variances: F= .126 P= .730

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	1.92	10	.084	1.971	(-2.465, 10.031)
Unequal	1.92	9.53	.085	1.971	(-2.465, 10.031)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 2 times (4/2)	6	83987.1097	7768.858	3171.623	
Mean Difference = 29070.8202					
Levene's Test for Equality of Variances: F= 6.841 P= .026					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	8.72	10	.000	3332.398	(18507.23, 39634.41)
Unequal	8.72	6.03	.000	3332.398	(16712.88, 41428.76)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 2 times (4/2)	6	1.8642	.692	.283	
Mean Difference = 1.4330					
Levene's Test for Equality of Variances: F= .042 P= .842					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	3.35	10	.007	.428	(.076, 2.790)
Unequal	3.35	9.84	.008	.428	(.076, 2.790)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 2 times (4/2)	6	.0003	.000	.000

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Mean Difference = .0004

Levene's Test for Equality of Variances: F= .514 P= .490

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.96	10	.014	.000	(.000, .001)
Unequal	2.96	9.85	.015	.000	(.000, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 2 times (4/2)	6	61.7167	3.212	1.311

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Mean Difference = 3.7667

Levene's Test for Equality of Variances: F= .233 P= .640

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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Equal	2.10	10	.063	1.797	(-1.930, 9.464)
Unequal	2.10	9.96	.063	1.797	(-1.930, 9.464)

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t-tests for independent samples of RECAST (the time of casting)

Variable	Number of Cases	Mean	SD	SE of Mean	
TENSILE					
never cast before	6	113057.9298	2504.815	1022.586	
cast 3 times (4/3)	6	71291.8742	7901.210	3225.655	
Mean Difference = 41766.0557					
Levene's Test for Equality of Variances: F= 3.324 P= .098					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	12.34	10	.000	3383.864	(31039.32, 52492.79)
Unequal	12.34	5.99	.000	3383.864	(29217.26, 54314.85)

Variable	Number of Cases	Mean	SD	SE of Mean	
ELONGATE					
never cast before	6	3.2972	.788	.322	
cast 3 times (4/3)	6	.7818	1.184	.483	
Mean Difference = 2.5153					
Levene's Test for Equality of Variances: F= .435 P= .524					
t-test for Equality of Means					
Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
Equal	4.33	10	.001	.581	(.675, 4.356)
Unequal	4.33	8.70	.002	.581	(.628, 4.402)

Variable	Number of Cases	Mean	SD	SE of Mean
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STRAIN

never cast before	6	.0006	.000	.000
cast 3 times (4/3)	5	.0012	.001	.000

.....

Mean Difference = -.0006

Levene's Test for Equality of Variances: F= 33.533 P= .000

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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.....

Equal	-1.81	9	.103	.000	(-.002, .000)
Unequal	-1.67	4.58	.162	.000	(-.002, .001)

Variable	Number of Cases	Mean	SD	SE of Mean
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.....

HARDNESS

never cast before	6	65.4833	3.010	1.229
cast 3 times (4/3)	6	64.0667	3.880	1.584

.....

Mean Difference = 1.4167

Levene's Test for Equality of Variances: F= .692 P= .425

t-test for Equality of Means

Variances	t-value	df	2-Tail Sig	SE of Diff	99% CI for Diff
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.....

Equal	.71	10	.496	2.005	(-4.939, 7.772)
Unequal	.71	9.42	.497	2.005	(-5.100, 7.934)

.....

SPSS for MS WINDOWS Release 6.0

*** CELL MEANS ***

TENSILE

by RECAST. the time of casting

RATIO ration of the old and new alloys' weight

Total Population

86050.93

(67)

RECAST	1	2	3	
	102000.99	84520.25	71498.45	
	(23)	(21)	(23)	
RATIO	1	2	3	4
	83992.64	80901.12	87090.36	91476.47
	(16)	(16)	(17)	(18)
RATIO	1	2	3	4
RECAST 1	97172.15	94197.86	96183.03	119150.41
	(6)	(5)	(6)	(6)
2	83881.01	84184.71	86134.82	83987.11
	(5)	(5)	(5)	(6)
3	68288.85	67084.18	78793.97	71291.87
	(5)	(6)	(6)	(6)

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*** ANALYSIS OF VARIANCE ***

TENSILE

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	11754368644	5	2350873728.80	63.782	.000
RECAST	10714031941	2	5357015970.44	145.343	.000
RATIO	983044338	3	327681445.895	8.890	.000
2-Way Interactions					
RECAST RATIO	1934386374	6	322397728.957	8.747	.000
Explained	13688755018	11	1244432274.34	33.763	.000
Residual	2027176977	55	36857763.211		
Total	15715931994	66	238120181.732		

67 cases were processed.

0 cases (.0 pct) were missing.

SPSS for MS WINDOWS Release 6.0

*** CELL MEANS ***

ELONGATE

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Population

1.32

(67)

RECAST	1	2	3	
	1.40	1.29	1.28	
	(23)	(21)	(23)	
RATIO	1	2	3	4
	.54	1.39	1.48	1.82
	(16)	(16)	(17)	(18)
RATIO	1	2	3	4
RECAST 1	.66	.89	1.18	2.80
	(6)	(5)	(6)	(6)
2	.34	1.69	1.15	1.86
	(5)	(5)	(5)	(6)
3	.59	1.56	2.06	.78
	(5)	(6)	(6)	(6)

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*** ANALYSIS OF VARIANCE ***

ELONGATE

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	15.066	5	3.013	4.273	.002
RECAST	.365	2	.183	.259	.773
RATIO	14.841	3	4.947	7.016	.000
2-Way Interactions					
RECAST RATIO	17.177	6	2.863	4.060	.002
Explained	32.243	11	2.931	4.157	.000
Residual	38.781	55	.705		
Total	71.024	66	1.076		

67 cases were processed.

0 cases (.0 pct) were missing.

SPSS for MS WINDOWS Release 6.0

*** CELL MEANS ***

STRAIN

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Population

.00
(64)

RECAST	1	2	3	
	.00	.00	.00	
	(23)	(21)	(20)	
RATIO	1	2	3	4
	.00	.00	.00	.00
	(16)	(14)	(17)	(17)
RATIO	1	2	3	4
RECAST 1	.00	.00	.00	.00
	(6)	(5)	(6)	(6)
2	.00	.00	.00	.00
	(5)	(5)	(5)	(6)
3	.00	.00	.00	.00
	(5)	(4)	(6)	(5)

SPSS for MS WINDOWS Release 6.0

*** ANALYSIS OF VARIANCE ***

STRAIN

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	.000	5	.000	3.208	.013
RECAST	.000	2	.000	3.968	.025
RATIO	.000	3	.000	2.437	.075
2-Way Interactions	.000	6	.000	2.255	.052
RECAST, RATIO	.000	6	.000	2.255	.052
Explained	.000	11	.000	2.688	.008
Residual	.000	52	.000		
Total	.000	63	.000		

67 cases were processed.

3 cases (4.5 pct) were missing.

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*** CELL MEANS ***

HARDNESS

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Population

61.16

(67)

RECAST

1 2 3

60.17 59.90 63.30

(23) (21) (23)

RATIO

1 2 3 4

60.35 62.82 58.96 62.49

(16) (16) (17) (18)

RATIO

1 2 3 4

RECAST 1

59.28 62.86 57.30 61.70

(6) (5) (6) (6)

2

61.52 60.70 55.32 61.72

(5) (5) (5) (6)

3

60.46 64.55 63.65 64.07

(5) (6) (6) (6)

SPSS for MS WINDOWS Release 6.0

*** ANALYSIS OF VARIANCE ***

HARDNESS

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	326.926	5	65.385	6.461	.000
RECAST	157.985	2	78.992	7.806	.001
RATIO	166.143	3	55.381	5.473	.002
2-Way Interactions					
RECAST RATIO	133.190	6	22.198	2.194	.057
Explained	460.117	11	41.829	4.134	.000
Residual	556.560	55	10.119		
Total	1016.677	66	15.404		

67 cases were processed.

0 cases (.0 pct) were missing.

----- ONEWAY -----

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 1

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	2275304970	1137652485	61.1660	.0000
Within Groups	13	241792556.1	18599427.40		
Total	15	2517097526			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 1

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5.2941

The actual range used is the listed RANGE * 1874.3599

with the following value(s) for RANGE: 3.90

(*) Indicates significant differences which are shown in the lower triangle

Mean	RECAST	Grp 3	Grp 2	Grp 1
68288.8470	Grp 3			
83881.0068	Grp 2	*		
97172.1512	Grp 1	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3	Subset 2	Group	Grp 2
*	Mean	68288.8470	Mean	83881.0068	

Subset 3	Group	Grp 1
	Mean	97172.1512

Variable ELONGATE

By Variable RECAST (the time of casting) RATIO 1

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.3124	.1562	.7440	.4944
Within Groups	13	2.7297	.2100		
Total	15	3.0421			

Variable ELONGATE

By Variable RECAST (the time of casting) RATIO 1

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5.2941

The actual range used is the listed RANGE * .1992

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 2	Grp 3	Grp 1
	Mean	.3364	.5884	.6648

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Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 1**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	1.9685	.1791
Within Groups	13	.0000	.0000		
Total	15	.0000			

Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 1**

Multiple Range Tests: **Scheffe test** with significance level .05

Harmonic Mean Cell size = 5.2941

The actual range used is the listed RANGE * .0001

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 2	Grp 3	Grp 1
	Mean	.0003	.0004	.0005

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----- O N E W A Y -----

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 2

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	2083374030	1041687015	23.2512	.0001
Within Groups	13	582419379.7	44801490.75		
Total	15	2665793410			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 2

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq 4732.9426 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.90

(*) Indicates significant differences which are shown in the lower triangle

Mean	RECAST	Grp 3	Grp 2	Grp 1
67084.1785	Grp 3			
84184.7076	Grp 2	*		
94197.8644	Grp 1	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2
	Mean	94197.8644	84184.7076

Subset 2	Group	Grp 3
	Mean	67084.1785

Variable **ELONGATE**

By Variable **RECAST** (the time of casting) **RATIO 2**

Analysis of Variance

Source	D.F.	Sum of Squares	MeanSquares	F Ratio	F Prob.
Between Groups	2	1.8804	.9402	.9132	.4255
Within Groups	13	13.3841	1.0295		
Total	15	15.2646			

Variable **ELONGATE**

By Variable **RECAST** (the time of casting) **RATIO 2**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .7175 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3
	Mean	.887	1.688	1.599

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Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 2**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	1.8341	.2054
Within Groups	11	.0000	.0000		
Total	13	.0000			

Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 2**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0005 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.99

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3
	Mean	.0001	.0009	.0003

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----- O N E W A Y -----

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 3

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	913605359.8	456802679.9	12.9116	.0007
Within Groups	14	495309496.8	35379249.77		
Total	16	1408914857			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq 4205.9036 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.87

(*) Indicates significant differences which are shown in the lower triangle

Mean	RECAST	Grp 3	Grp 2	Grp 1
78793.9705	Grp 3			
86134.8172	Grp 2			
96183.0272	Grp 1	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1
*	Mean	96183.0272

Subset 2	Group	Grp 2	Grp 3
	Mean	86134.8172	78793.9705

Variable **ELONGATE**

By Variable **RECAST** (the time of casting) **RATIO 3**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	3.1105	1.5553	1.8910	.1875
Within Groups	14	11.5140	.8224		
Total	16	14.6245			

Variable **ELONGATE**

By Variable **RECAST** (the time of casting) **RATIO 3**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .6413 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.87

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3
	Mean	1.175	1.150	2.059

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Variable STRAIN

By Variable RECAST (the time of casting) RATIO 3

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	2.7684	.0970
Within Groups	14	.0001	.0000		
Total	16	.0001			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0016 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.87

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3
	Mean	.0007	.0003	.0003

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----- O N E W A Y -----

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 4

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	7376133954	3688066977	78.1750	.0000
Within Groups	15	707655543.9	47177036.26		
Total	17	8083789498			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 4

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq 4856.8012 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.84

(*) Indicates significant differences which are shown in the lower triangle

		Grp	Grp	Grp
Mean	RECAST	3	2	1
71291.8742	Grp 3			
83987.1097	Grp 2	*		
119150.4150	Grp 1	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3	Subset 2	Group	Grp 2
	Mean	71291.8742		Mean	83987.1097

Subset 3	Group	Grp 1
	Mean	119150.4150

Variable **STRAIN**By Variable **RECAST** (the time of casting) **RATIO 4****Analysis of Variance**

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	6.9872	.0079
Within Groups	14	.0000	.0000		
Total	16	.0000			

Variable **STRAIN**By Variable **RECAST** (the time of casting) **RATIO 4**Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0003 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.87

(*) Indicates significant differences which are shown in the lower triangle

		Grp 2	Grp 1	Grp 3
Mean RECAST		2	1	3
.0003	Grp 2			
.0004	Grp 1			
.0012	Grp 3	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3
	Mean	.0012

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 2	Group	Grp 2	Grp 1
	Mean	.0004	.0003

Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 4**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	6.9872	.0079
Within Groups	14	.0000	.0000		
Total	16	.0000			

Variable **STRAIN**

By Variable **RECAST** (the time of casting) **RATIO 4**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0003 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 3.87

(*) Indicates significant differences which are shown in the lower triangle

		Grp 2	Grp 1	Grp 3
Mean RECAST		2	1	3
.0003	Grp 2			
.0004	Grp 1			
.0012	Grp 3	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3
	Mean	.0012

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 2	Group	Grp 2	Grp 1
	Mean	.0004	.0003

----- O N E W A Y -----

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	2412058769	804019589.6	66.0584	.0000
Within Groups	19	231255419.0	12171337.84		
Total	22	2643314188			

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$MEAN(J)-MEAN(I) \geq 2466.9149 * RANGE * SQRT(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.33

(*) Indicates significant differences which are shown in the lower triangle

Mean	RATIO	Grp 2	Grp 3	Grp 1	Grp 4
94197.8644	Grp 2				
96183.0272	Grp 3				
97172.1512	Grp 1				
119150.4150	Grp 4	*	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 4
	Mean	119150.4150

Subset 2	Group	Grp 1	Grp 3	Grp 2
	Mean	97172.1512	96183.0272	94197.8644

Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 1**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	16.6200	5.5400	16.4790	.0000
Within Groups	19	6.3875	.3362		
Total	22	23.0075			

Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 1**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .4100 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.33

(*) Indicates significant differences which are shown in the lower triangle

	Grp	Grp	Grp	Grp	
Mean	RATIO	1	2	3	4
.6648	Grp 1				
.8868	Grp 2				
1.1752	Grp 3				
2.7998	Grp 4	*	*	*	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 4
	Mean	2.7998

Subset 2	Group	Grp 3	Grp 2	Grp 1
	Mean	1.1752	.8868	.6648

Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 1**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000	2.9808	.0573
Within Groups	19	.0000	.0000		
Total	22	.0000			

Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 1**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0002 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3	Grp 4
	Mean	.0005	.0001	.0007	Homogeneous Subsets

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----- O N E W A Y -----

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	17345670.76	5781890.254	.1609	.9212
Within Groups	17	610818411.1	35930494.77		
Total	20	628164081.9			

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq 4238.5431 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.38

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 2	Grp 3	Grp 4
	Mean	83,881.007	84,184.708	86,134.817	83,987.109

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Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 2**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	7.4145	2.4715	5.2934	.0092
Within Groups	17	7.9373	.4669		
Total	20	15.3518			

Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 2**

Multiple Range Tests: **Scheffe test** with significance level .05

Harmonic Mean Cell size = 5.2174

The actual range used is the listed RANGE * .2991

with the following value(s) for RANGE: 4.38

(*) Indicates significant differences which are shown in the lower triangle

		Grp 1	Grp 3	Grp 2	Grp 4
Mean RATIO		1	3	2	4
.3364	Grp 1				
1.1502	Grp 3				
1.6880	Grp 2	*			
1.8642	Grp 4	*	*		

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 1	Grp 3	
	Mean	.3364	1.1502	

Subset 2	Group	Grp 3	Grp 2	Grp 4
	Mean	1.1502	1.6880	1.8642

Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 2**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000	1.7047	.2038
Within Groups	17	.0000	.0000		
Total	20	.0000			

Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 2**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0004 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.38

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 2	Grp 4	Grp 3	Grp 1
	Mean	.0009	.0003	.0003	.0003

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----- O N E W A Y -----

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	488026272.0	162675424.0	2.6081	.0815
Within Groups	19	1185103147	62373849.82		
Total	22	1673129418			

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq 5584.5255 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3	Grp 4	Grp 1	Grp 2
Mean		78,793.969	71,299.874	68,288.847	67,084.180

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Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 3**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	7.9834	2.6611	2.0674	.1385
Within Groups	19	24.4565	1.2872		
Total	22	32.4399			

Variable **ELONGATE**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 3**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .8022 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3	Grp 2	Grp 4	Grp 1
	Mean	2.059	1.559	0.782	0.588

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Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 3**

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000	2.1661	.1319
Within Groups	16	.0001	.0000		
Total	19	.0001			

Variable **STRAIN**

By Variable **RATIO** (ratio of the old and new alloys weight) **CASTING 3**

Multiple Range Tests: **Scheffe test** with significance level .05

The difference between two means is significant if

$$\text{MEAN}(J) - \text{MEAN}(I) \geq .0015 * \text{RANGE} * \text{SQRT}(1/N(I) + 1/N(J))$$

with the following value(s) for RANGE: 4.41

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1	Group	Grp 3	Grp 4	Grp 1	Grp 2
	Mean	.0032	.0012	.0003	.0003

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ประวัติผู้เขียน

นายปรินทร หริรักษาพิทักษ์ เกิดวันที่ 24 เมษายน พ.ศ. 2512 ที่อำเภอหาดใหญ่ จังหวัดสงขลา สำเร็จการศึกษาปริญญาตรีทันตแพทยศาสตรบัณฑิต คณะทันตแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์ ในปีการศึกษา 2536 สำเร็จการศึกษาระดับประกาศนียบัตรบัณฑิต สาขาวิทยาศาสตร์การแพทย์คลินิก (ทันตกรรมประดิษฐ์) คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2538 และเข้าศึกษาต่อในหลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชาทันตกรรมประดิษฐ์ ที่จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2538 ปัจจุบันรับราชการในตำแหน่งอาจารย์ประจำภาควิชาทันตกรรมอนุรักษ์ คณะทันตแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์



สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย