

LAMPIRAN A
PERHITUNGAN

Lampiran A. Perhitungan

A1. Hasil Penelitian *Hot Compression* INSTRON 4507

A.1.1 ΣZ

$$Z = \varepsilon \exp\left(\frac{245,43}{RT}\right)$$

a) C₁ 1050 0,1

$$Z = 2,20993 \times 10^{26} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 2,2598 \times 10^{26}$$

b) C₁ 1050 0,01

$$Z = 6,02131 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 6,15721 \times 10^{24}$$

c) C₁ 1050 0,001

$$Z = 3,52129 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 3,60076 \times 10^{23}$$

d) C₂ 1050 0,1

$$Z = 7,17056 \times 10^{25} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 7,3324 \times 10^{25}$$

e) C₂ 1050 0,01

$$Z = 1,72522 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 1,76416 \times 10^{24}$$

f) C₂ 1050 0,001

$$Z = 1,35506 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 1,38564 \times 10^{23}$$

g) C₃ 1050 0,1

$$Z = 4,36299 \times 10^{26} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 4,46147 \times 10^{26}$$

h) C₃ 1050 0,01

$$Z = 9,73338 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 9,95306 \times 10^{24}$$

i) C₃ 1050 0,001

$$Z = 4,79268 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1323}\right) = 4,90085 \times 10^{23}$$

j) C₁ 1100 0,1

$$Z = 1,21619 \times 10^{25} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 1,24263 \times 10^{25}$$

k) C₁ 1100 0,01

$$Z = 1,40183 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 1,43231 \times 10^{24}$$

l) C_1 1100 0,001

$$Z = 9,93707 \times 10^{22} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 1,01531 \times 10^{23}$$

m) C_2 1100 0,1

$$Z = 4,72856 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 4,83136 \times 10^{24}$$

n) C_2 1100 0,01

$$Z = 5,95165 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 6,08104 \times 10^{23}$$

o) C_2 1100 0,001

$$Z = 1,90116 \times 10^{22} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 1,9425 \times 10^{22}$$

p) C_3 1100 0,1

$$Z = 3,46221 \times 10^{25} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 3,53748 \times 10^{25}$$

q) C_3 1100 0,01

$$Z = 2,93632 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 3,00015 \times 10^{24}$$

r) C_3 1100 0,001

$$Z = 1,09176 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1373}\right) = 1,1155 \times 10^{23}$$

A.1.2 ΣQ (KJ.mol⁻¹)

$$Z = \varepsilon \exp\left(\frac{Q}{RT}\right)$$

a) C_1 1050 0,1

$$2,2598 \times 10^{26} = 2,20993 \times 10^{26} \exp\left(\frac{Q}{8,31 \times 1323}\right)$$

$$Q = 245,36921$$

b) C_1 1050 0,01

$$6,15721 \times 10^{24} = 6,02131 \times 10^{24} \exp\left(\frac{Q}{8,31 \times 1323}\right)$$

$$Q = 245,36699$$

c) C_1 1050 0,001

$$3,60076 \times 10^{23} = 3,52129 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1323}\right)$$

$$Q = 245,36188$$

d) C₂ 1050 0,1

$$7,3324 \times 10^{25} = 7,17056 \times 10^{25} \exp\left(\frac{Q}{8,31 \times 1323}\right)$$

$$Q = 245,38941$$

e) C₂ 1050 0,01

$$1,76416 \times 10^{24} = 1,72522 \times 10^{24} \exp\left(\frac{Q}{8,31 \times 1323}\right)$$

$$Q = 245,37984$$

f) C₂ 1050 0,001

$$1,38564 \times 10^{23} = 1,35506 \times 10^{23} \exp\left(\frac{Q}{8,31 \times 1323}\right)$$

$$Q = 245,34933$$

g) C₃ 1050 0,1

$$4,46147 \times 10^{26} = 4,36299 \times 10^{26} \exp\left(\frac{245,43}{8,31 \times 1323}\right)$$

$$Q = 245,39674$$

h) C₃ 1050 0,01

$$9,95306 \times 10^{24} = 9,73338 \times 10^{24} \exp\left(\frac{245,43}{8,31 \times 1323}\right)$$

$$Q = 245,37608$$

i) C₃ 1050 0,001

$$4,90085 \times 10^{23} = 4,79268 \times 10^{23} \exp\left(\frac{245,43}{8,31 \times 1323}\right)$$

$$Q = 245,37605$$

j) C₁ 1100 0,1

$$1,24263 \times 10^{25} = 1,21619 \times 10^{25} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,38782$$

k) C₁ 1100 0,01

$$1,43231 \times 10^{24} = 1,40183 \times 10^{24} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,37114$$

l) C₁ 1100 0,001

$$1,01531 \times 10^{23} = 9,93707 \times 10^{22} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,36542$$

m) C₂ 1100 0,1

$$4,83136 \times 10^{24} = 4,72856 \times 10^{24} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,39017$$

n) C₂ 1100 0,01

$$6,08104 \times 10^{23} = 5,95165 \times 10^{23} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,37987$$

o) C₂ 1100 0,001

$$1,9425 \times 10^{22} = 1,90116 \times 10^{22} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,37922$$

p) C₃ 1100 0,1

$$3,53748 \times 10^{25} = 3,46221 \times 10^{25} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,39757$$

q) C₃ 1100 0,01

$$3,00015 \times 10^{24} = 2,93632 \times 10^{24} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,39627$$

r) C₃ 1100 0,001

$$1,1155 \times 10^{23} = 1,09176 \times 10^{23} \exp\left(\frac{Q}{8,31 \times 1373}\right)$$

$$Q = 245,39001$$

A.1.3 $\Sigma\sigma$ (Laju DRV MPa)

$$\sigma = \frac{1}{a} \ln \left\{ \left(\frac{Z}{A} \right)^{\frac{1}{n}} + \left[\left(\frac{Z}{A} \right)^{\frac{2}{n}} + 1 \right] \right\}^{\frac{1}{2}}$$

a) $C_1 1050 0,1$

$$\sigma = \frac{1}{0,0108} \ln\{60,10427 + 60,11258\} = 443,45344$$

b) $C_1 1050 0,01$

$$\sigma = \frac{1}{0,0108} \ln\{29,23938 + 29,25647\} = 376,75517$$

c) $C_1 1050 0,001$

$$\sigma = \frac{1}{0,0108} \ln\{16,57182 + 16,60196\} = 324,23702$$

d) $C_2 1050 0,1$

$$\sigma = \frac{1}{0,0108} \ln\{47,98888 + 47,9993\} = 422,61343$$

e) $C_2 1050 0,01$

$$\sigma = \frac{1}{0,0108} \ln\{22,77188 + 22,79383\} = 353,62551$$

f) $C_2 1050 0,001$

$$\sigma = \frac{1}{0,0108} \ln\{13,69057 + 13,72704\} = 306,59125$$

g) $C_3 1050 0,1$

$$\sigma = \frac{1}{0,0108} \ln\{213744,81842 + 213744,70754\}$$

$$\sigma = 1200,5264$$

h) $C_3 1050 0,01$

$$\sigma = \frac{1}{0,0108} \ln\{99905,94323 + 99905,95578\}$$

$$\sigma = 1130,10479$$

i) $C_3 1050 0,001$

$$\sigma = \frac{1}{0,0108} \ln\{54708,43382 + 54708,40887\}$$

$$\sigma = 1074,34445$$

j) $C_1 1100 0,1$

$$\sigma = \frac{1}{0,0108} \ln\{104440,36162 + 104440,41364\}$$

$$\sigma = 1134,21471$$

k) C_1 1100 0,01

$$\sigma = \frac{1}{0,0108} \ln\{67796,52043 + 67796,53384\}$$

$$\sigma = 1094,20495$$

l) C_1 1100 0,001

$$\sigma = \frac{1}{0,0108} \ln\{39931,87774 + 39931,8169\}$$

$$\sigma = 1045,19228$$

m) C_2 1100 0,1

$$\sigma = \frac{1}{0,0108} \ln\{86459,73098 + 86459,75943\}$$

$$\sigma = 1116,7205$$

n) C_2 1100 0,01

$$\sigma = \frac{1}{0,0108} \ln\{57120,96977 + 57121,0119\}$$

$$\sigma = 1078,3402$$

o) C_2 1100 0,001

$$\sigma = \frac{1}{0,0108} \ln\{28686,14607 + 28686,1465\}$$

$$\sigma = 1014,56637$$

p) C_3 1100 0,1

$$\sigma = \frac{1}{0,0108} \ln\{128747,49819 + 128747,42716\}$$

$$\sigma = 1253,58845$$

q) C_3 1100 0,01

$$\sigma = \frac{1}{0,0108} \ln\{78601,09455 + 78601,08142\}$$

$$\sigma = 1107,89704$$

r) C_3 1100 0,001

$$\sigma = \frac{1}{0,0108} \ln\{40690,58324 + 40690,53945\}$$

$$\sigma = 1266,93506$$

A2. Hasil Penelitian *Hot Tensile* INSTRON 4507

A.2.1 UTS (*Ultimate Tensile Strength*)

$$UTS = \frac{F_{max} \times 1000}{D_0^2}$$

a) C1 1050

$$UTS = \frac{364,2683142 \times 1000}{67,404} = 5404,25367$$

b) C1 1100

$$UTS = \frac{195,2026954 \times 1000}{66,912} = 2917,30475$$

c) C2 1050

$$UTS = \frac{302,8942857 \times 1000}{67,0761} = 4515,68123$$

d) C2 1100

$$UTS = \frac{248,5603614 \times 1000}{66,7489} = 3723,8121$$

e) C3 1050

$$UTS = \frac{430,1674528 \times 1000}{67,7329} = 6350,93806$$

f) C3 1100

$$UTS = \frac{294,7344141 \times 1000}{67,0761} = 4394,03027$$

LAMPIRAN B
DATA PENELITIAN

Lampiran B. Data Penelitian

C.1 Hasil Hot Compression Test

C1 1050					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
25.8954	0.0292704	7.44574	0.0013155	2.88127	0.000788402
25.9173	0.041496	13.2045	0.0153673	3.65686	0.001402
26.5215	0.0828877	13.7561	0.0355046	4.19003	0.002192
28.928	0.220089	14.0668	0.0471963	4.4604	0.002894
30.0975	0.340326	14.4191	0.063966	4.71987	0.003509
30.5136	0.409626	15.2971	0.133206	10.5935	0.696656
30.7809	0.474911	16.7275	0.646404	10.5915	0.697359
30.8962	0.571022	17.1773	0.670102	10.5841	0.698063
30.8838	0.683578	17.2909	0.697539	10.5602	0.698767
31.0891	0.697527	17.2587	0.698772	10.5691	0.699472

C2 1050					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
20.1935	0.0269988	7.17327	0.001139	4.57976	0.000700158
20.419	0.041459	8.20947	0.00298167	5.66047	0.00140081
20.5604	0.0579807	8.60183	0.004388	6.00661	0.00210195
20.8039	0.0724298	8.76568	0.00562	6.18827	0.00280358
20.9654	0.0869955	8.98038	0.007206	6.33633	0.0035935
26.6868	0.640414	14.0934	0.694374	9.42222	0.697355
26.7338	0.652416	14.0955	0.695778	9.42106	0.698059
27.0253	0.671035	14.0563	0.697008	9.44169	0.698762
27.0786	0.683067	13.9929	0.698415	9.45683	0.699466
27.0477	0.695596	14.0435	0.699472	9.45683	0.699466

C3 1050					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
28.6768	0.017238	6.95962	0.001402	5.16561	0.0007
28.3312	0.0316073	10.5471	0.00307	8.12271	0.001401
28.9054	0.0460944	11.858	0.004388	8.94113	0.00219
29.4385	0.0605151	12.7293	0.005884	9.16646	0.002804
29.7486	0.0769435	13.112	0.007294	9.29182	0.003506
34.6633	0.642731	18.1192	0.692972	10.8196	0.696653
34.4289	0.655141	18.1387	0.6949	10.8175	0.697355
34.6785	0.667194	18.1645	0.69648	10.7934	0.698059
35.1888	0.681298	18.1747	0.697711	10.8242	0.698762
35.1994	0.693498	18.1816	0.699119	10.8221	0.699466

C1 1100					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
6.62017	0.018989	3.22055	0.001665	1.37315	0.000701
7.78852	0.031461	4.65507	0.00307	2.07478	0.00149
8.53021	0.043816	5.59516	0.004564	2.72026	0.002192
9.97518	0.060406	6.20634	0.00606	3.43113	0.002806
12.0185	0.074445	6.73121	0.007206	4.07466	0.003597
19.6985	0.638169	13.2271	0.693498	8.83469	0.696656
19.6135	0.650668	13.2764	0.694725	8.80111	0.697359
19.4298	0.662985	13.2687	0.696129	8.82227	0.698063
19.5371	0.677005	13.2477	0.697711	8.81059	0.698767
19.8933	0.691399	13.2446	0.698767	8.84808	0.699472

C2 1100					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
11.3881	0.031579	2.75457	0.001751	2.57474	0.000701
12.0257	0.043855	4.28371	0.003155	3.14227	0.001402
12.4469	0.06046	5.46063	0.004648	3.36953	0.002192
13.0506	0.074984	6.20043	0.006143	3.52053	0.002806
13.2522	0.08733	6.6788	0.007553	3.66009	0.003509
16.8933	0.634482	11.1349	0.694198	6.68102	0.696656
16.8647	0.646444	11.15	0.695775	6.67087	0.697359
16.7554	0.659059	11.0948	0.696828	6.68254	0.698063
16.7325	0.673207	11.1118	0.698234	6.68329	0.698767
16.8609	0.687384	11.1523	0.699466	6.66768	0.699472
C3 1100					
0,1		0,01		0,001	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
10.8368	0.014554	7.15282	0.001139	1.58589	0.000788
13.4788	0.029322	8.68445	0.002718	1.80504	0.001402
16.539	0.043398	9.23353	0.004124	2.01258	0.002192
17.642	0.058138	9.5739	0.005356	2.16543	0.002806
18.3851	0.072627	9.82471	0.006677	2.35041	0.003509
22.9645	0.642274	15.0818	0.693322	8.86894	0.696656
22.9612	0.654499	15.1158	0.694725	8.90112	0.697359
23.0344	0.666705	15.1854	0.695953	8.88389	0.698063
23.111	0.680963	15.1337	0.697183	8.86668	0.698767
23.1103	0.693498	15.0711	0.698415	8.87138	0.699472

C.2 Hasil Hot Tensile Test

1050					
C1		C2		C3	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
1.27971	0.0036457	0.943182	0.00379494	0.953016	0.00390994
1.35069	0.00707669	0.936785	0.00714133	0.984558	0.0072013
1.336	0.0103286	5.80195	0.0103767	2.69735	0.0104484
6.27962	0.0134365	10.2752	0.0136016	11.2997	0.0135851
11.9969	0.0168342	10.6761	0.0169153	13.6775	0.0167784
2.26006	0.625651	0.323378	0.483954	1.61647	0.532276
2.06958	0.627458	0.246894	0.486025	1.42723	0.534257
1.87839	0.629262	0.278331	0.488093	0.594519	0.536235
1.73975	0.631063	0.309895	0.490156	0.450795	0.538208
0.889225	0.632861	0.27948	0.492215	0.403289	0.540178

1100					
C1		C2		C3	
TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.	TENSIO.VER	DEF.VERT.
0.457905	0.00267159	1.04355	0.00380419	0.876128	0.00337838
0.382634	0.00541208	1.06642	0.00729529	0.936855	0.00721587
0.345305	0.00811981	1.73478	0.0104434	0.959058	0.010436
0.336544	0.0105934	8.04533	0.0137796	5.62871	0.0136793
0.327753	0.0131111	8.71246	0.0171046	10.0224	0.0171782
0.285684	0.629508	0.468535	0.598539	0.527642	0.616876
0.321831	0.630865	0.538936	0.600375	0.493365	0.618701
0.304363	0.63222	0.522508	0.602207	0.441308	0.620522
0.322703	0.633573	0.43622	0.604036	0.47748	0.62234
0.251331	0.634924	0.489459	0.605862	0.478347	0.624154

LAMPIRAN C
GAMBAR ALAT DAN BAHAN

Lampiran C. Gambar Alat dan Bahan

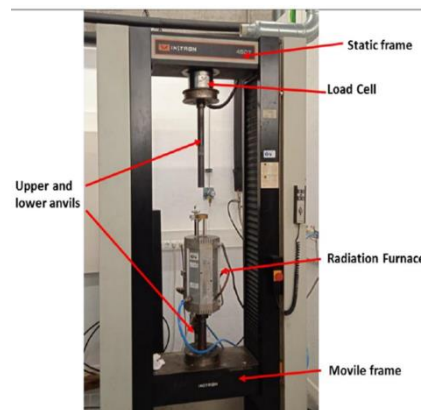
C.1 Gambar Alat dan Bahan



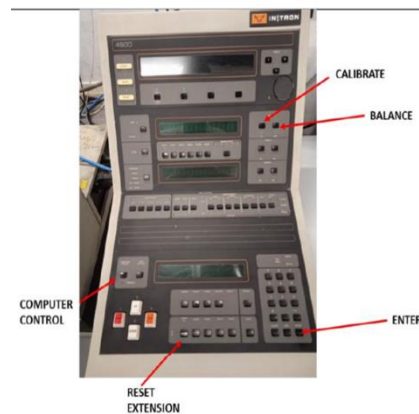
Gambar C.1 *Quartz Glass Tube*



Gambar C.2 *Radiation Furnace*



Gambar C.3 *Test Machine
Hot Compression and Tensile*



Gambar C.4 *Radiation Furnace*



Gambar C.5 *Argon*



Gambar C.6 *Boron Nitride*



Gambar C.7 Silicon Steel



Gambar C.8 Etanol



Gambar C.9 Tantalum Sheets