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# LAMPIRAN

## LAMPIRAN I

### TABEL DAN GRAFIK HASIL PENGUJIAN

Tabel A. 1

Tabel pengujian *bending* aluminium *anodizing*

Tegangan (Volt)	Konsentrasi Larutan (Molar)	Force (N)	Kekuatan <i>bending</i> (MPa)	Rata-rata (MPa)
6,0	2,5	1141,31	930,74	1050,45
		1364,85	1085,21	
		1404,04	1135,39	
9,0	2,5	1437,98	1159,54	1249,91
		1630,11	1269,45	
		1679,75	1320,76	
12,0	2,5	1524,07	1228,88	1120,63
		1303,19	1062,91	
		1340,24	1070,10	
15,0	2,0	1001,01	1038,10	1042,52
		1028,83	1049,54	
		1004,21	1039,92	
15,0	2,5	1131,7	1047,90	1130,70
		1308,77	1163,90	
		1302,24	1180,30	
15,0	3,0	1134,13	1092,87	1082,58
		1148,19	1077,97	
		1115,91	1076,89	
18,0	2,5	1106,58	1090,49	1058,34
		1016,86	1039,03	
		1021,14	1045,50	
Tanpa Perlakuan		1299,4	1026,01	1035,53
		1297,87	1019,16	
		1332,89	1061,43	

# METALURGI FISIK

## ALUMINIUM ANODIZING

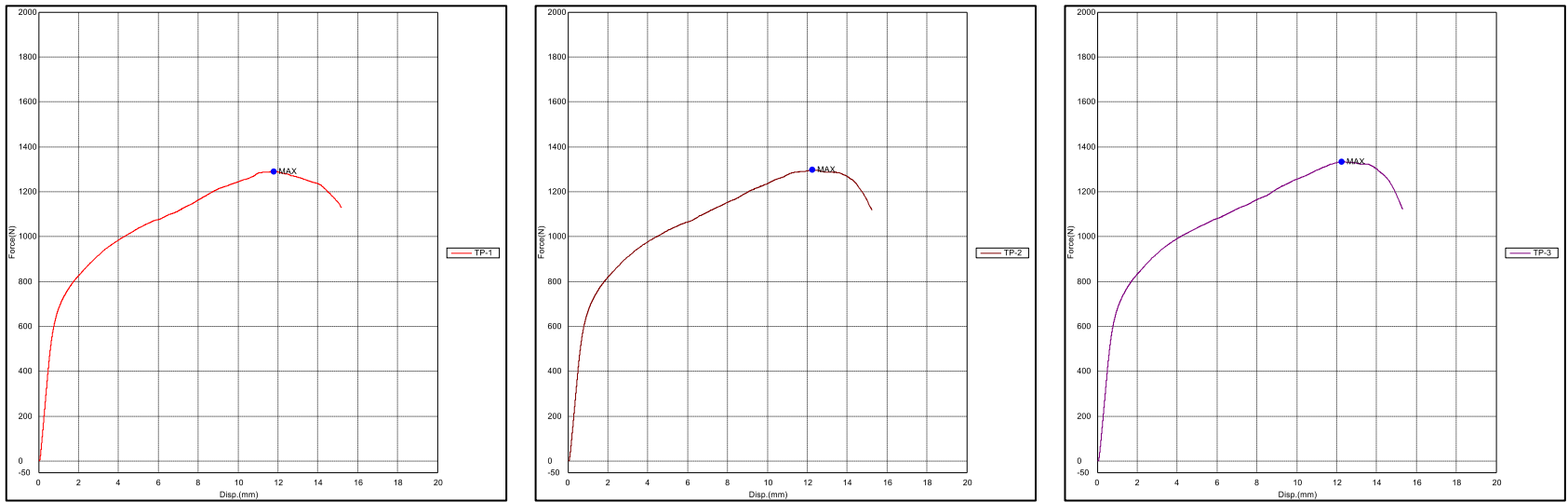
Tabel A.2

Tabel hasil pengujian bending aluminium anodizing

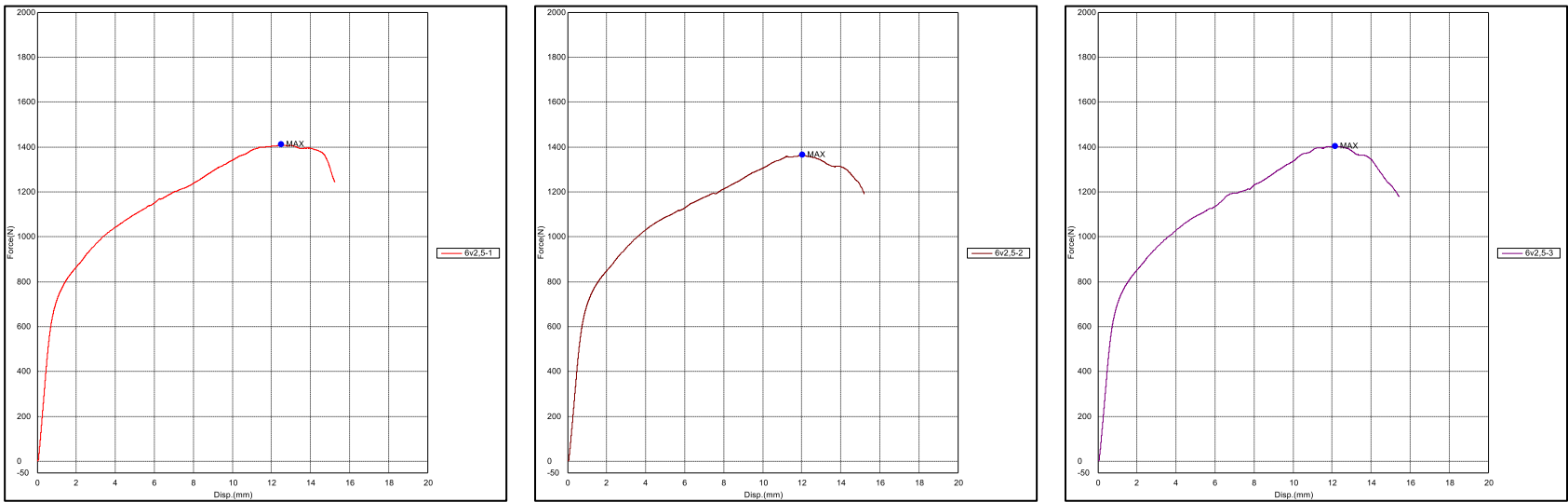
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<b>Report Date</b>	2022/01/25	<b>Test Date</b>	2022/01/24
<b>Test Type</b>	3 Point Bending	<b>Speed</b>	1 mm/min
<b>Shape</b>	Plate	<b>No. of Batches</b>	1
<b>Qty/Batch</b>	3		
Name	Thickness	Widht	Lower Support
Unit	mm	mm	mm
TP-1	2,88	7,10	31.000
TP-2	2,89	7,09	31.000
TP-3	2,88	7,04	31.000
6v2,5m-1	2,85	7,02	31.000
6v2,5m-2	2,87	7,10	31.000
6v2,5m-3	2,86	7,03	31.000
9v2,5m-1	2,86	7,05	31.000
9v2,5m-2	2,86	7,30	31.000
9v2,5m-3	2,88	7,13	31.000
12v2,5m-1	2,85	7,10	31.000
12v2,5m-2	2,86	6,97	31.000
12v2,5m-3	2,86	7,12	31.000
15v2m-1	2,54	6,95	31.000
15v2m-2	2,55	7,01	31.000
15v2m-3	2,54	6,96	31.000
15v2,5m-1	2,69	7,11	31.000
15v2,5m-2	2,68	7,26	31.000
15v2,5m-3	2,69	7,18	31.000
15v3m-1	2,66	6,82	31.000
15v3m-2	2,66	7,00	31.000
15v3m-3	2,66	6,81	31.000
18v2,5m-1	2,56	7,20	31.000
18v2,5m-2	2,57	6,86	31.000

18v2,5m-3	2,56	6,93	31.000
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<b>Name Parameters</b> Unit	<b>Max Force</b> Calc. At Entire Area N	<b>Max Disp</b> Calc. At Entire Area mm	<b>Break Force</b> Sensitivity 10 N	<b>Break Disp</b> Sensitivity 10 mm
TP-1	1289,40	11,7792	.-	.-
TP-2	1297,87	12,2595	.-	.-
TP-3	1332,89	12,2609	.-	.-
6v2,5m-1	1411,31	12,5060	.-	.-
6v2,5m-2	1364,85	12,0225	.-	.-
6v2,5m-3	1404,04	12,1501	.-	.-
9v2,5m-1	1437,98	14,2632	.-	.-
9v2,5m-2	1630,11	13,9046	.-	.-
9v2,5m-3	1679,75	13,7747	.-	.-
12v2,5m-1	1524,07	10,7510	.-	.-
12v2,5m-2	1303,19	11,1124	.-	.-
12v2,5m-3	1340,24	11,3343	.-	.-
15v2m-1	1001,01	11,8849	.-	.-
15v2m-2	1028,83	11,3446	.-	.-
15v2m-3	1004,21	11,4073	.-	.-
15v2,5m-1	1131,70	12,2642	.-	.-
15v2,5m-2	1308,77	12,6233	.-	.-
15v2,5m-3	1302,24	14,0287	.-	.-
15v3m-1	1134,13	13,8846	.-	.-
15v3m-2	1148,19	12,4832	.-	.-
15v3m-3	1115,91	11,4544	.-	.-
18v2,5m-1	1106,58	12,6942	.-	.-
18v2,5m-2	1016,86	12,3177	.-	.-
18v2,5m-3	1021,14	12,2047	.-	.-

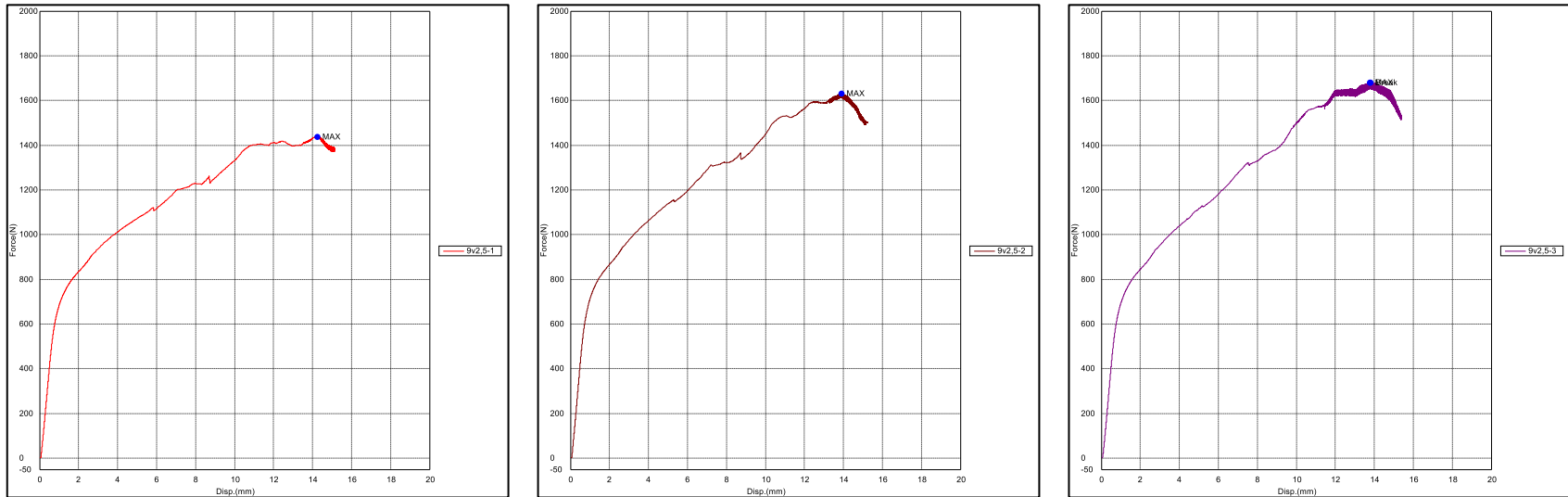


**Gambar A. 1** Grafik hasil pengujian bending aluminium tanpa perlakuan

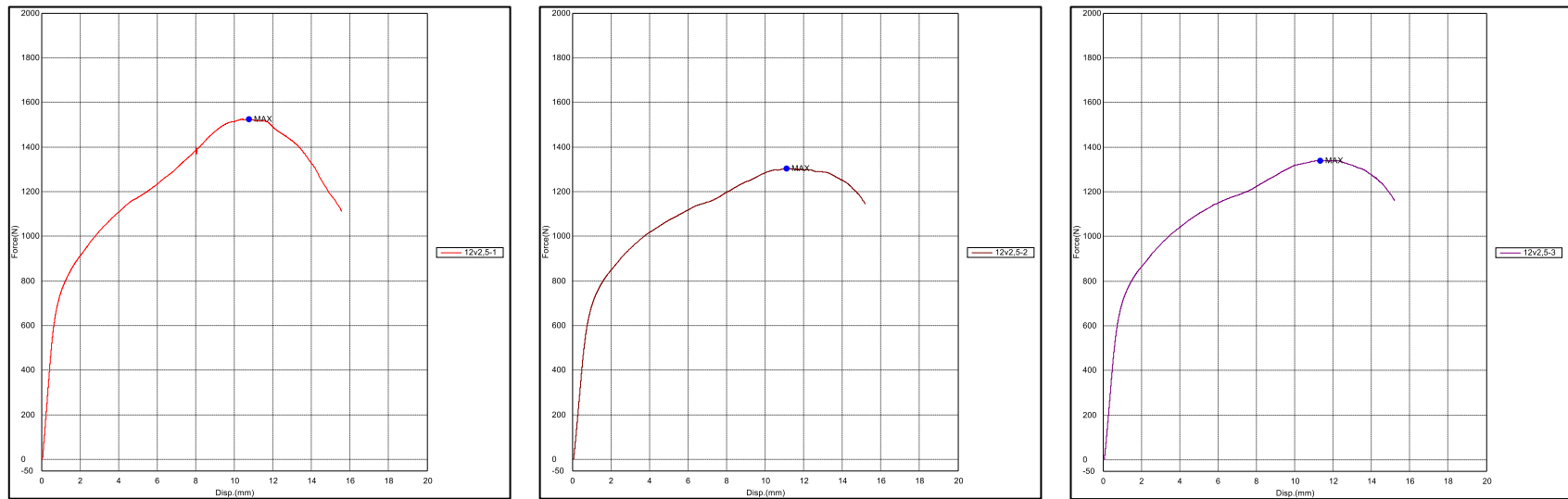


**Gambar A. 2** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 6 volt dengan konsentrasi larutan 2,5 molar

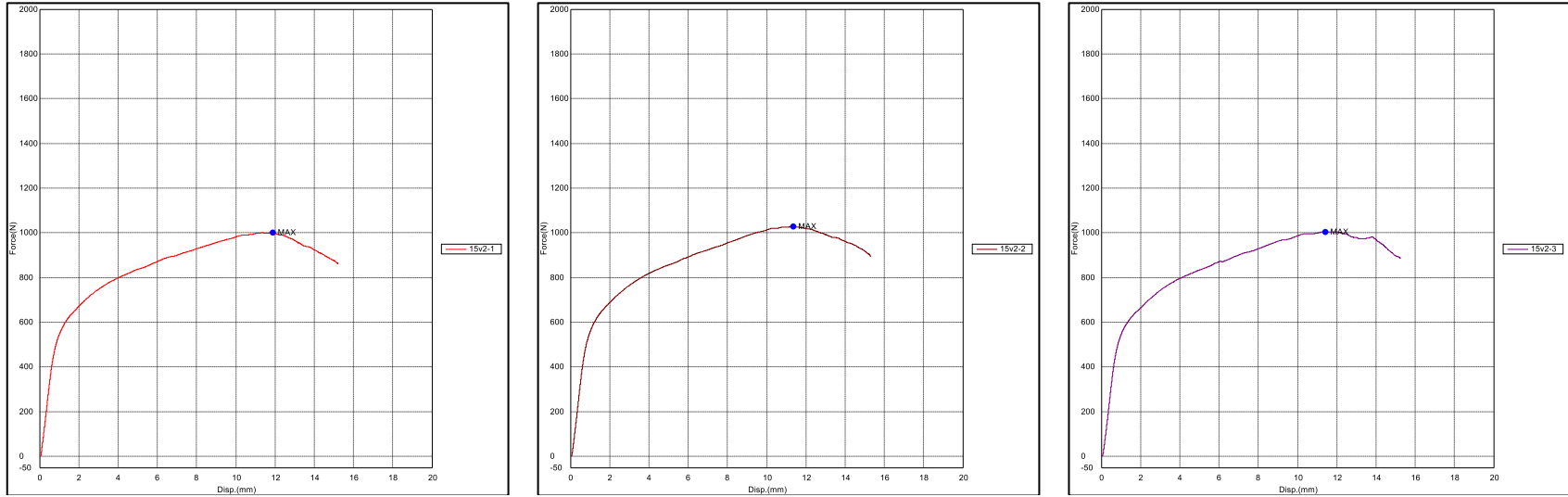




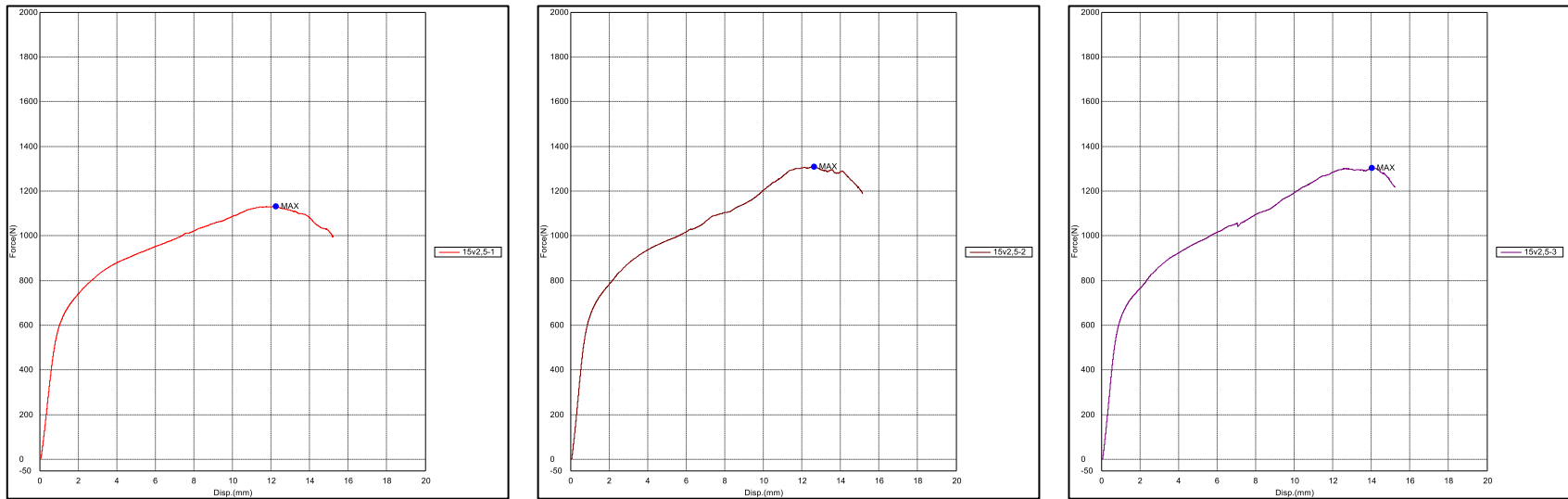
**Gambar A. 3** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 9 volt dengan konsentrasi larutan 2,5 molar



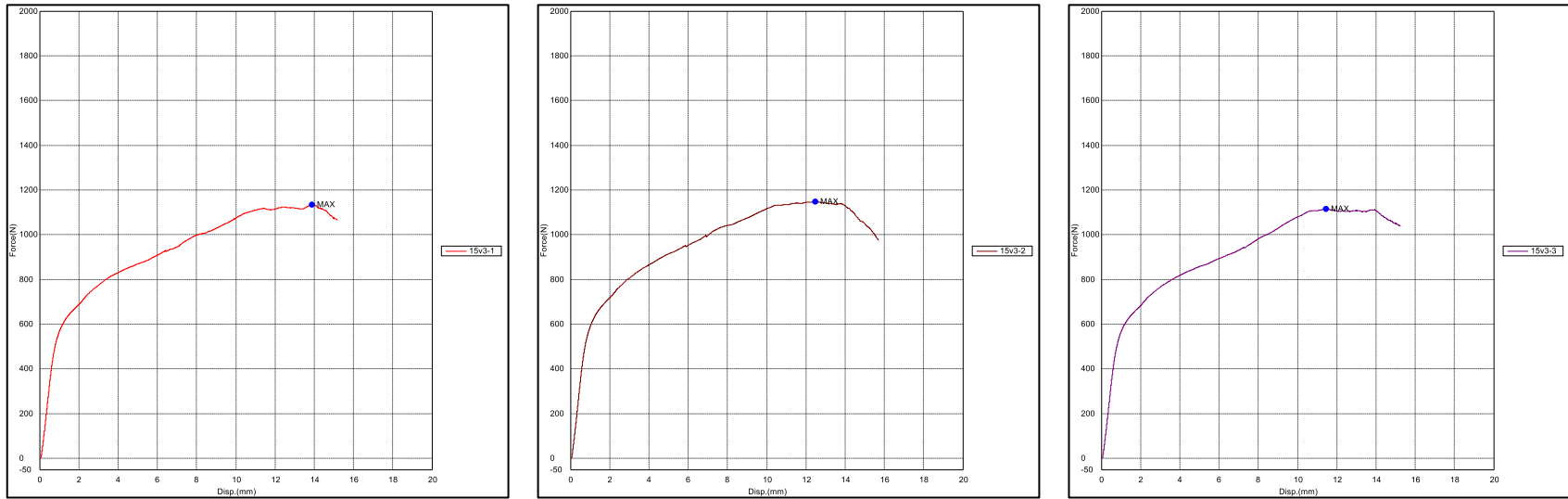
**Gambar A. 4** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 12 volt dengan konsentrasi larutan 2,5 molar



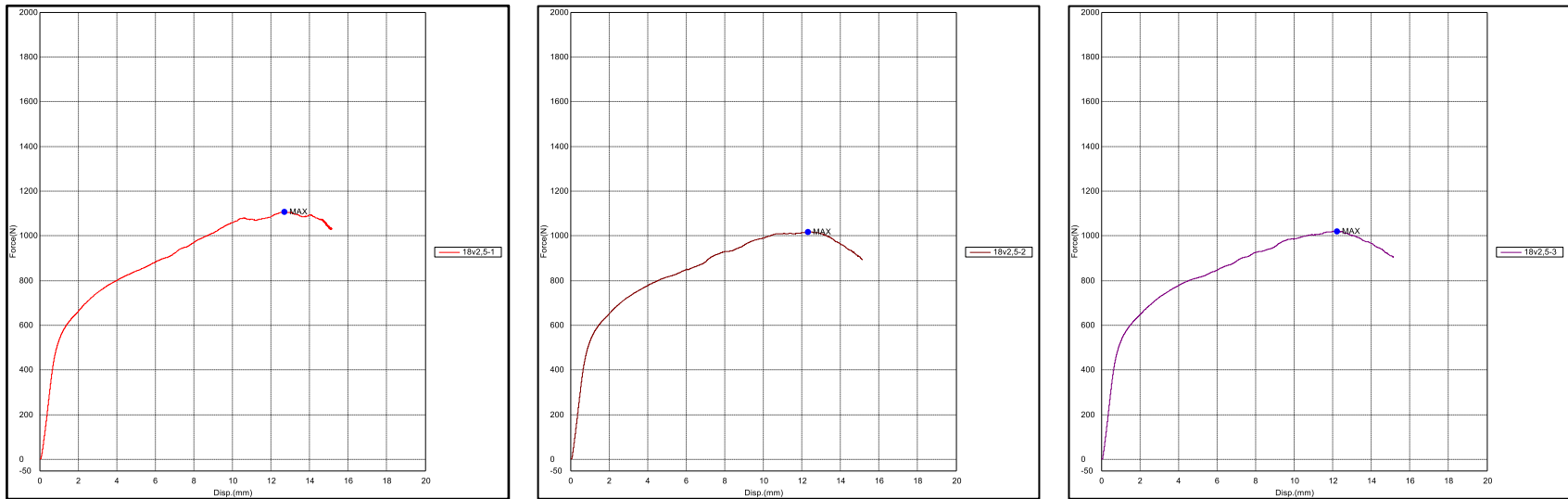
**Gambar A. 5** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 15 volt dengan konsentrasi larutan 2 molar



**Gambar A. 6** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 15 volt dengan konsentrasi larutan 2,5 molar



**Gambar A. 7** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 15 volt dengan konsentrasi larutan 3 molar



**Gambar A. 8** Grafik hasil pengujian bending aluminium *anodizing* pada tegangan 18 volt dengan konsentrasi larutan 2,5 molar

**Tabel A. 3**Pengukuran sudut tetesan air pada pengujian *wettability*

Tegangan (Volt)	Konsentrasi Larutan (M)	Tetesan Air ( $^{\circ}$ )			Rata-Rata ( $^{\circ}$ )
		1	2	3	
Tanpa Perlakuan		86,5	87,5	89	87,7
6	2	59	54	52	55,0
6	2,5	64	67	75	68,7
6	3	52	52	74	59,3
9	2	53	39	39	43,7
9	2,5	57,5	55	65	59,2
9	3	43	40	47	43,3
12	2	42	40	35	39,0
12	2,5	61	58	48	55,7
12	3	36,5	44	41	40,5
15	2	79	84	80	81,0
15	2,5	76	86	78	80,0
15	3	88	78	79	81,7
18	2	59	64	58	60,3
18	2,5	82	77	92	83,7

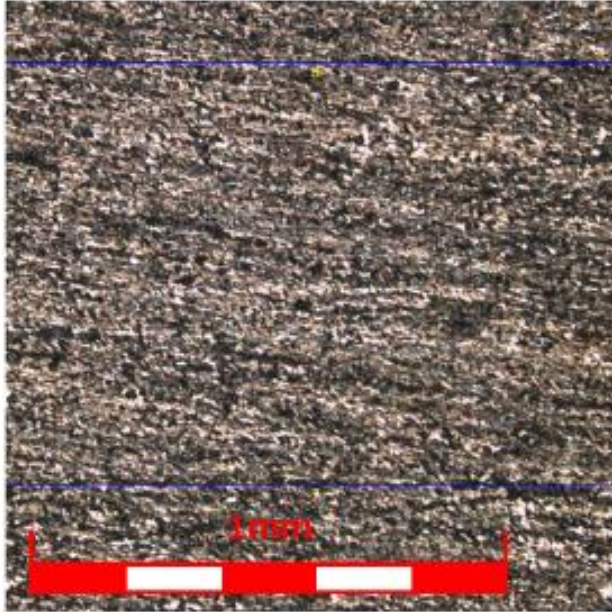
**Tabel A. 4**Pengukuran diameter tetesan air pada pengujian *wettability*

Tegangan (Volt)	Konsentrasi Larutan ( Molar)	Tetesan Air (mm)			Rata-Rata (mm)
		1	2	3	
Tanpa Perlakuan		5,2	5,1	5,5	5,3
6	2	6,5	6,3	6,5	6,4
6	2,5	5,8	5,8	5,7	5,8
6	3	6,7	6,5	5,7	6,3
9	2	7,5	7,3	7,8	7,5
9	2,5	6,7	6,4	6,8	6,6
9	3	7,1	7,2	6,9	7,1
12	2	7	8	8,2	7,7
12	2,5	6,7	6,5	7	6,7
12	3	8	7,5	7	7,5
15	2	5	4,9	5	5,0
15	2,5	5,4	4,5	5,7	5,2
15	3	5,2	5,8	5,6	5,5
18	2	6,5	6,2	6,5	6,4
18	2,5	5	5,5	5	5,2

**Tabel A. 5**Hasil pengujian kekasaran permukaan aluminium *anodizing*

Tegangan (Volt)	Konsentrasi (M)	Kekasaran Ra ( $\mu\text{m}$ )	Rata-Rata ( $\mu\text{m}$ )	Standar Deviasi
Tanpa Perlakuan		1,80	1,93	0,21
		2,18		
		1,82		
6	2,5	2,67	2,59	0,07
		2,57		
		2,53		
9	2,5	2,63	2,65	0,06
		2,61		
		2,72		
12	2,5	3,35	3,18	0,15
		3,09		
		3,10		
15	2	4,39	4,24	0,24
		4,37		
		3,97		
15	2,5	3,59	3,76	0,55
		4,38		
		3,32		
15	3	4,77	4,37	0,93
		5,04		
		3,30		
18	2,5	3,86	3,83	0,28
		4,09		
		3,53		

# Report Title



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 User name: Administrator  
 Description: FIRST ADMINISTRATOR

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 Zoom: 1x  
 DIC: off

No.	Result	Rp[μm]	Rv[μm]	Rz[μm]	Rc[μm]	Rt[μm]	Ra[μm]	Rq[μm]	λc[μm]	λs[μm]	λf[μm]	File name
<input checked="" type="checkbox"/>	1	8.103	9.333	17.436	8.333	28.071	1.801	2.291	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	2	11.821	7.655	19.477	12.325	19.477	2.189	2.744	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	3	12.042	10.248	22.291	12.276	22.291	1.824	2.442	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	4	11.655	11.617	23.272	11.748	23.272	2.125	2.795	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	5	10.073	9.692	19.765	12.722	19.765	2.136	2.753	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	6	11.352	13.633	24.985	15.041	28.385	2.337	3.094	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	7	11.656	14.184	25.840	13.706	25.840	2.344	3.199	800.00	2.500	-	220610
<input checked="" type="checkbox"/>	8	13.469	7.364	20.833	11.164	20.833	1.801	2.369	800.00	2.500	-	220610

**Gambar A. 9** Kekasaran aluminium tanpa perlakuan

# Report Title

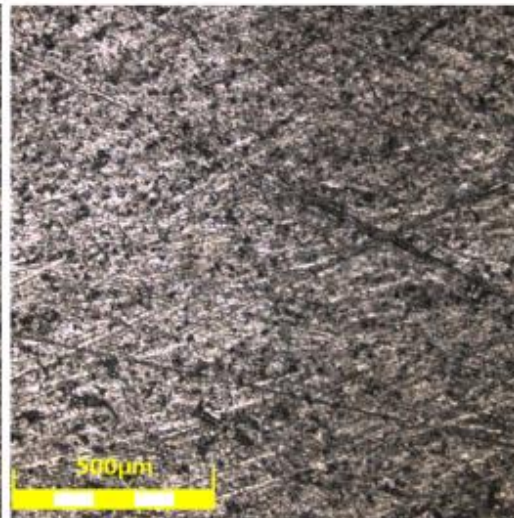
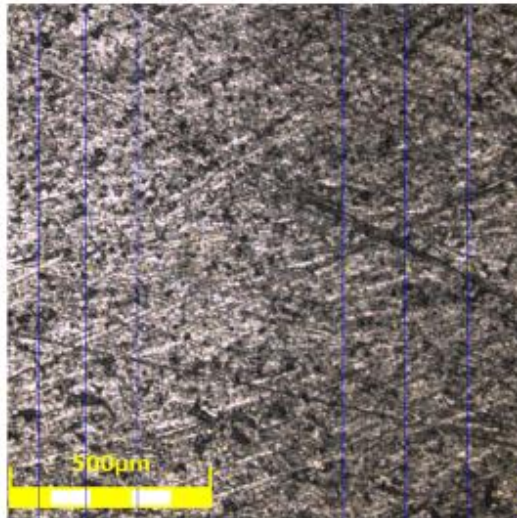


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 Zoom: 1x  
 DIC: Off

No.	Result	Rp[µm]	Rv[µm]	Rz[µm]	Rc[µm]	Rt[µm]	Ra[µm]	Rq[µm]	λc[µm]	λs[µm]	λf[µm]	File name
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<input checked="" type="checkbox"/>	2	10.147	14.838	24.984	12.378	25.143	2.579	3.329	800.000	2.500	--	- 220210_11
<input checked="" type="checkbox"/>	3	11.009	19.274	30.284	14.265	30.284	2.533	3.363	800.000	2.500	--	- 220210_11
<input checked="" type="checkbox"/>	4	10.874	9.277	20.151	11.203	21.129	2.105	2.749	800.000	2.500	--	- 220210_11
<input checked="" type="checkbox"/>	5	18.433	8.893	27.326	12.287	27.808	2.126	2.848	800.000	2.500	--	- 220210_11
<input checked="" type="checkbox"/>	6	9.989	10.113	20.102	10.531	22.285	2.206	2.819	800.000	2.500	--	- 220210_11

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 Description: FIRST ADMINISTRATOR USER

Comment

**Gambar A. 10** Kekasaran permukaan aluminium anodisasi pada tegangan 6 volt pada konsentrasi larutan asam sulfat 2,5 molar



# Report Title

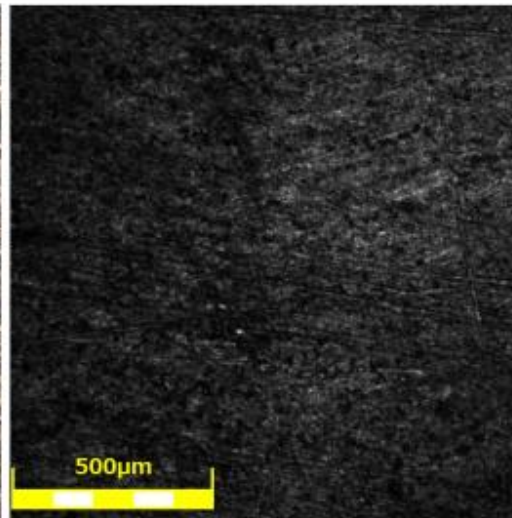
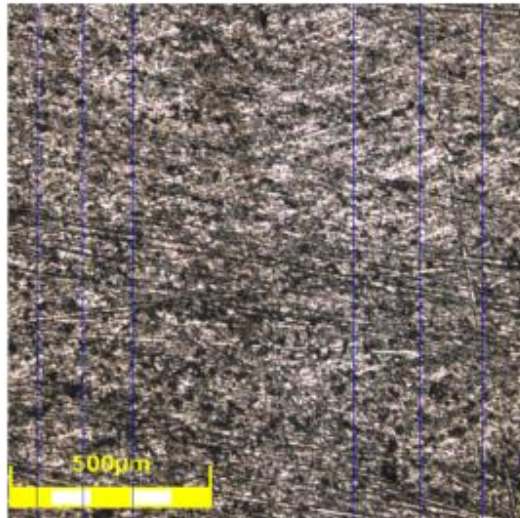


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 Filter:Gaussian Filter  
 Analysis parameter:R parameter

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 Zoom: 1x  
 DIC: Off

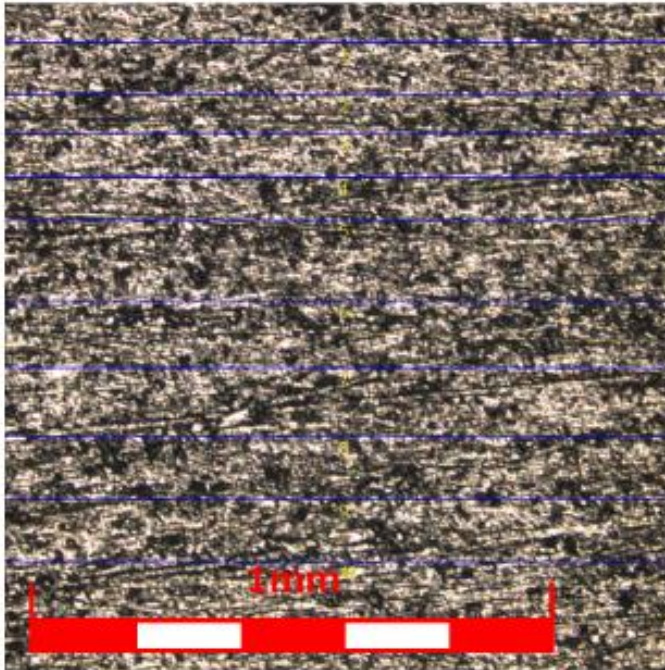
No.	Result	Rp[µm]	Rv[µm]	Rz[µm]	Rc[µm]	Rt[µm]	Ra[µm]	Rq[µm]	λc[µm]	λs[µm]	λf[µm]	File name
<input checked="" type="checkbox"/>	1	21.650	24.934	46.583	23.092	46.583	3.738	5.217	800.000	2.500	--	220210_11
<input checked="" type="checkbox"/>	2	18.622	17.632	36.254	21.896	45.980	3.696	5.022	800.000	2.500	--	220210_11
<input checked="" type="checkbox"/>	3	15.996	17.110	33.106	17.490	33.106	3.156	4.137	800.000	2.500	--	220210_11
<input checked="" type="checkbox"/>	4	10.363	18.702	29.065	16.094	32.561	2.661	3.672	800.000	2.500	--	220210_11
<input checked="" type="checkbox"/>	5	12.568	18.855	31.423	17.401	36.186	2.992	3.859	800.000	2.500	--	220210_11
<input checked="" type="checkbox"/>	6	19.308	16.048	35.355	16.734	35.355	3.027	4.138	800.000	2.500	--	220210_11

User ID: ADMIN  
 User name: Administrator  
 Description: FIRST ADMINISTRATOR USER

Comment

**Gambar A. 11** Kekasaran permukaan aluminium anodisasi pada tegangan 9 volt pada konsentrasi larutan asam sulfat 2,5 molar

Report Title



220610\_154003  
 [Acquisition parameters]  
 Scanning mode: XYZ ultra fast scan + Color  
 Image size[pixels]: 1024X1024  
 Image size[μm]: 1280x1297  
 Objective lens: MPLFLN10x  
 Zoom: 1x  
 DIC: Off

No.	Result	Rp[μm]	Rv[μm]	Rz[μm]	Rc[μm]	Rt[μm]	Ra[μm]	Rq[μm]	λc[μm]	λs[μm]	λf[μm]	File name
✓ 1		17.110	20.787	37.897	17.212	37.897	3.351	4.435	800.00	2.500	-	220610
✓ 2		21.636	22.853	44.489	21.216	66.346	4.209	5.431	800.00	2.500	-	220610
✓ 3		16.637	27.821	44.458	19.355	44.458	3.087	4.310	800.00	2.500	-	220610
✓ 4		15.357	13.780	29.137	16.425	36.548	3.101	4.102	800.00	2.500	-	220610
✓ 5		16.082	19.014	35.096	19.601	37.622	3.598	4.721	800.00	2.500	-	220610
✓ 6		31.731	13.933	45.664	24.603	51.772	3.833	5.218	800.00	2.500	-	220610
✓ 7		39.174	27.610	66.784	35.585	72.892	5.261	8.027	800.00	2.500	-	220610
✓ 8		20.141	22.538	42.679	18.925	66.305	4.139	5.622	800.00	2.500	-	220610
✓ 9		31.912	25.361	57.273	28.755	57.273	5.126	6.785	800.00	2.500	-	220610
✓ 10		28.738	23.257	51.995	28.514	51.995	4.968	6.825	800.00	2.500	-	220610

**Gambar A. 12** Kekasaran permukaan aluminium anodisasi pada tegangan 12 volt pada konsentrasi larutan asam sulfat 2,5 molar

# Report Title

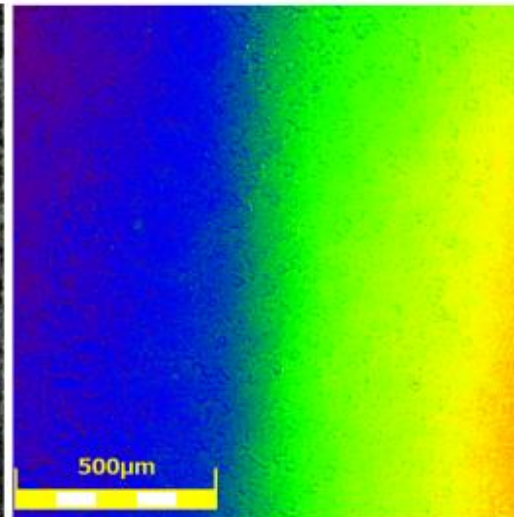
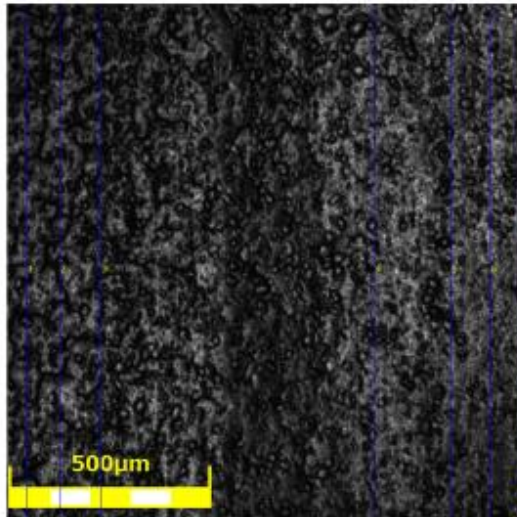


Image Name:220210\_115306  
 [Roughness Settings Information]  
 Measurement No.:6  
 Evaluation area:1280µm  
 Cutoff: λc 800.000 µm  
           λs 2.500 µm  
           λf -- µm  
 Filter:Gaussian Filter  
 Analysis parameter:R parameter

220210\_115306  
 [Acquisition parameters]  
 Scanning mode: XYZ fast scan + Color  
 Image size[pixels]: 1024X1024  
 Image size[µm]: 1280x1286  
 Objective lens: MPLFLN10x  
 Zoom: 1x  
 DIC: Off

No.	Result	Rp[µm]	Rv[µm]	Rz[µm]	Rc[µm]	Rt[µm]	Ra[µm]	Rq[µm]	λc[µm]	λs[µm]	λf[µm]	File name
<input checked="" type="checkbox"/>	1	23.543	28.950	52.492	30.419	52.492	4.399	6.216	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	2	24.573	27.225	51.798	28.216	51.798	4.373	6.102	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	3	20.343	17.717	38.060	21.002	43.825	3.971	5.400	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	4	24.274	20.685	44.958	17.372	44.958	2.979	4.322	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	5	12.913	18.179	31.093	16.916	33.342	2.736	3.784	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	6	8.654	15.495	24.149	15.289	24.149	2.798	3.691	800.000	2.500	-	220210_11

User ID: ADMIN  
 User name: Administrator  
 Description: FIRST ADMINISTRATOR USER

Comment

**Gambar A. 13** Kekasaran permukaan aluminium anodisasi pada tegangan 15 volt pada konsentrasi larutan asam sulfat 2 molar

# Report Title

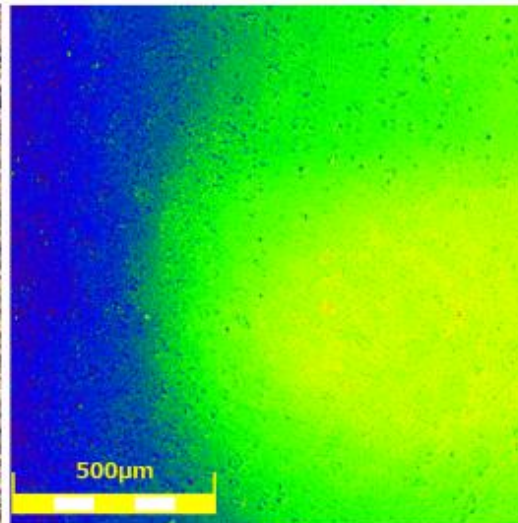
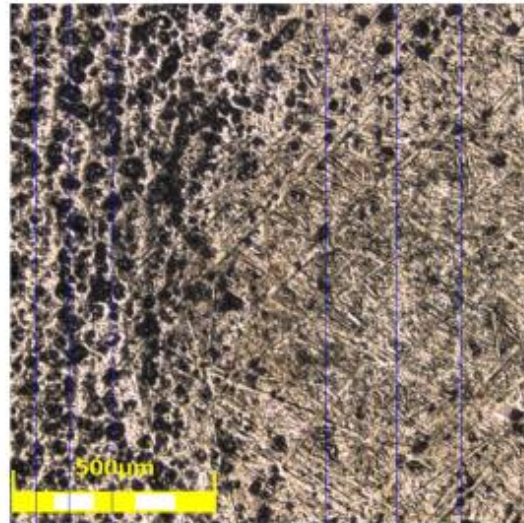


Image Name: 220210\_114534  
 [Roughness Settings Information]  
 Measurement No.: 6  
 Evaluation area: 1280 μm  
 Cutoff: λc 800.000 μm  
           λs 2.500 μm  
           λf - μm  
 Filter: Gaussian Filter  
 Analysis parameter: R parameter

220210\_114534  
 [Acquisition parameters]  
 Scanning mode: XYZ fast scan + Color  
 Image size[pixels]: 1024X1024  
 Image size[μm]: 1280x1286  
 Objective lens: MPLFLN10x  
 Zoom: 1x  
 DIC: Off

No.	Result	Rp[μm]	Rv[μm]	Rz[μm]	Rc[μm]	Rt[μm]	Ra[μm]	Rq[μm]	λc[μm]	λs[μm]	λf[μm]	File name
<input checked="" type="checkbox"/>	1	27.821	17.613	45.434	20.178	45.434	3.591	4.940	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	2	28.671	23.322	51.993	25.021	70.128	4.385	5.987	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	3	19.507	17.569	37.076	19.641	45.115	3.324	4.646	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	4	26.248	15.758	42.006	17.587	42.006	3.342	4.674	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	5	18.994	15.709	34.703	16.531	58.062	2.821	3.828	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	6	22.870	26.292	49.162	21.549	49.162	3.347	4.651	800.000	2.500	-	220210_11

User ID: ADMIN  
 User name: Administrator  
 Description: FIRST ADMINISTRATOR USER

Comment

**Gambar A. 14** Kekasaran permukaan aluminium anodisasi pada tegangan 15 volt pada konsentrasi larutan asam sulfat 2,5 molar

# Report Title

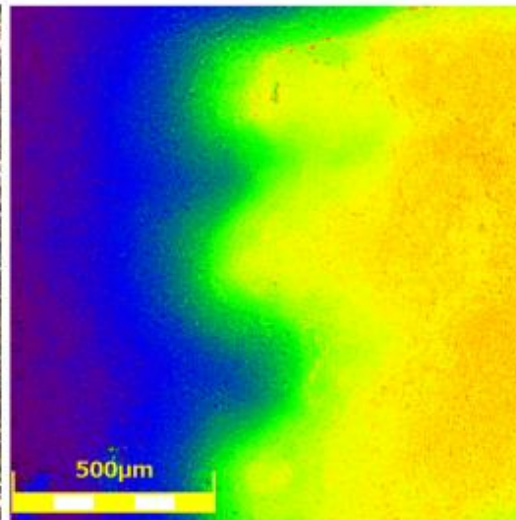
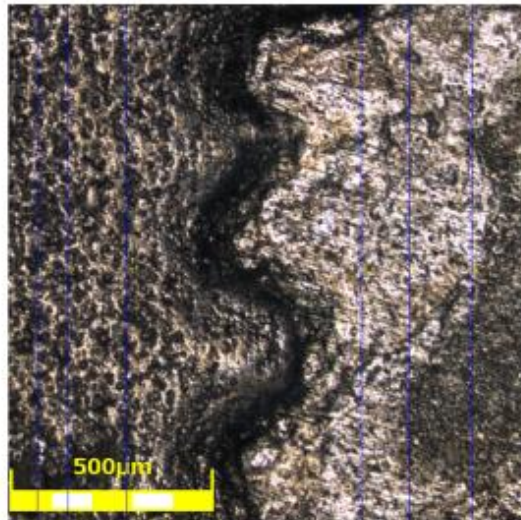


Image Name:220210\_115853  
 [Roughness Settings Information]  
 Measurement No.:6  
 Evaluation area:1280μm  
 Cutoff: λc 800.000 μm  
           λs 2.500 μm  
           λf -- μm  
 Filter:Gaussian Filter  
 Analysis parameter:R parameter

220210\_115853  
 [Acquisition parameters]  
 Scanning mode: XYZ fast scan + Color  
 Image size[pixels]: 1024X1024  
 Image size[μm]: 1280x1286  
 Objective lens: MPLFLN10x  
 Zoom: 1x  
 DIC: Off

No.	Result	Rp[μm]	Rv[μm]	Rz[μm]	Rc[μm]	Rt[μm]	Ra[μm]	Rq[μm]	λc[μm]	λs[μm]	λf[μm]	File name
<input checked="" type="checkbox"/>	1	20.278	23.933	44.212	21.478	44.212	4.776	6.328	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	2	43.704	19.306	63.010	28.656	63.010	5.041	7.775	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	3	18.594	13.965	32.559	15.077	32.559	3.301	4.234	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	4	15.591	11.395	26.985	15.880	70.818	3.050	3.857	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	5	9.224	16.024	25.248	15.031	67.847	2.724	3.477	800.000	2.500	-	220210_11
<input checked="" type="checkbox"/>	6	17.173	21.257	38.430	20.500	38.430	3.288	4.402	800.000	2.500	-	220210_11

User ID: ADMIN  
 User name: Administrator  
 Description: FIRST ADMINISTRATOR USER

Comment

**Gambar A. 15** Kekasaran permukaan aluminium anodisasi pada tegangan 15 volt pada konsentrasi larutan asam sulfat 3 molar

# Report Title

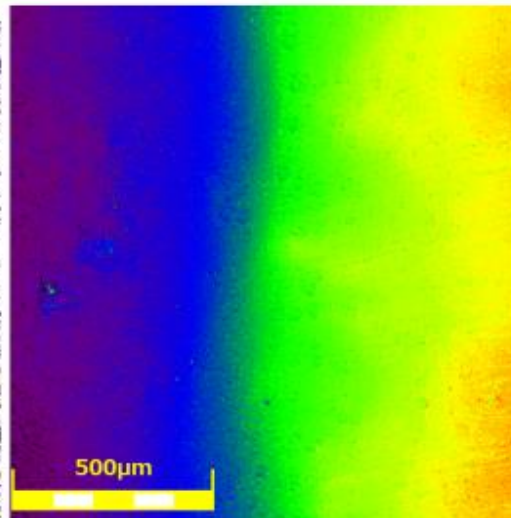
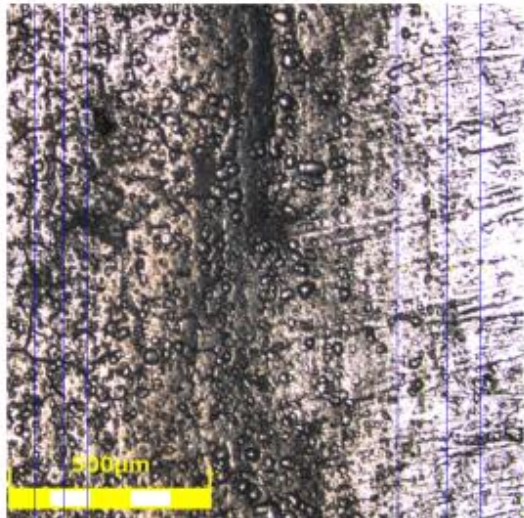


Image Name:220210\_120339  
 [Roughness Settings Information]  
 Measurement No.:6  
 Evaluation area:1280µm  
 Cutoff: λc 800.000 µm  
           λs 2.500 µm  
           λf -- µm  
 Filter:Gaussian Filter  
 Analysis parameter:R parameter

220210\_120339  
 [Acquisition parameters]  
 Scanning mode: XYZ fast scan + Color  
 Image size[pixels]: 1024X1024  
 Image size[µm]: 1280x1286  
 Objective lens: MPLFLN10x  
 Zoom: 1x  
 DIC: Off

No.	Result	Rp[µm]	Rv[µm]	Rz[µm]	Rc[µm]	Rt[µm]	Ra[µm]	Rq[µm]	λc[µm]	λs[µm]	λf[µm]	File name
<input checked="" type="checkbox"/>	1	36.317	22.211	58.527	21.982	58.527	3.860	5.692	800.000	2.500	-	220210_12
<input checked="" type="checkbox"/>	2	17.720	19.876	37.595	23.738	37.595	4.096	5.517	800.000	2.500	-	220210_12
<input checked="" type="checkbox"/>	3	28.906	19.366	48.272	20.920	48.272	3.516	4.892	800.000	2.500	-	220210_12
<input checked="" type="checkbox"/>	4	9.602	10.840	20.441	12.806	20.441	2.538	3.273	800.000	2.500	-	220210_12
<input checked="" type="checkbox"/>	5	48.704	14.811	63.515	22.550	66.093	3.941	6.063	800.000	2.500	-	220210_12
<input checked="" type="checkbox"/>	6	12.290	22.584	34.854	19.002	34.854	3.411	4.450	800.000	2.500	-	220210_12

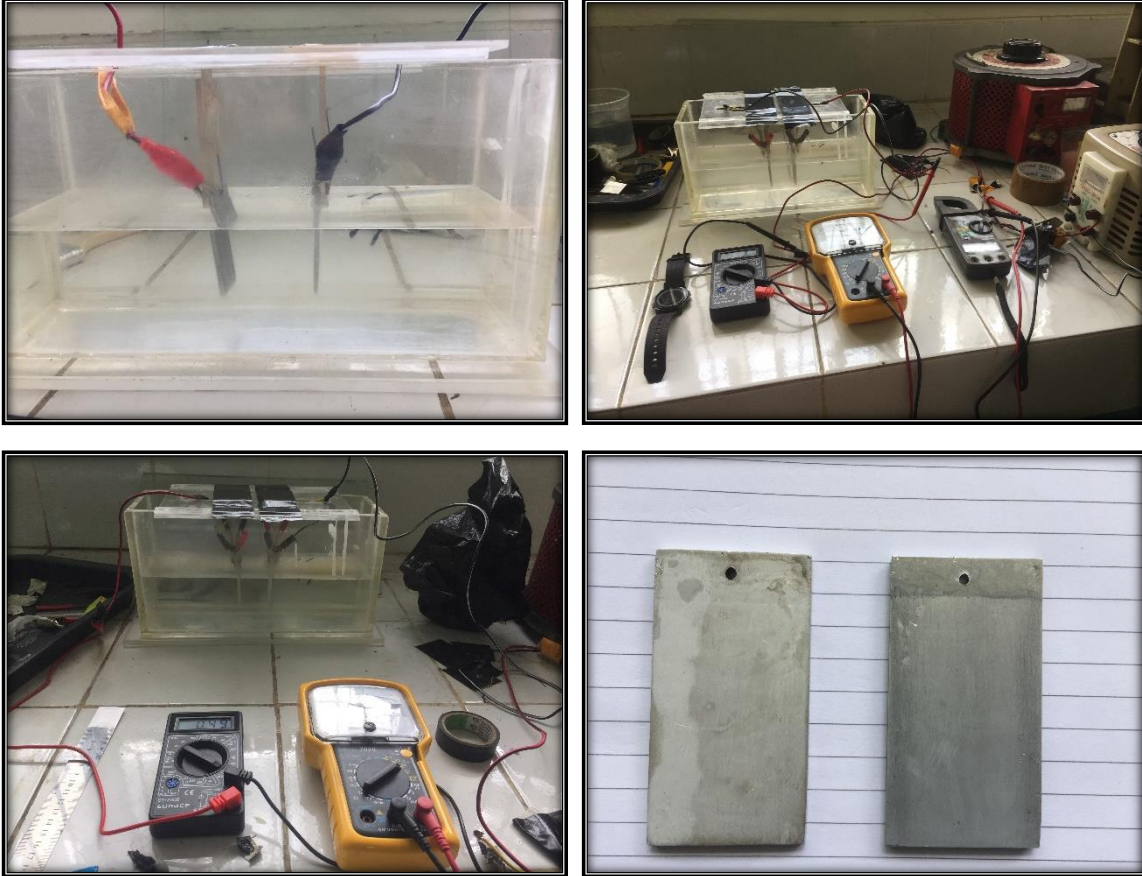
User ID: ADMIN  
 User name: Administrator  
 Description: FIRST ADMINISTRATOR USER

Comment

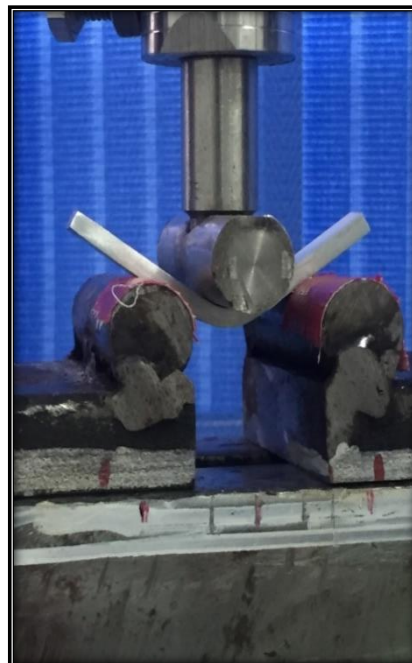
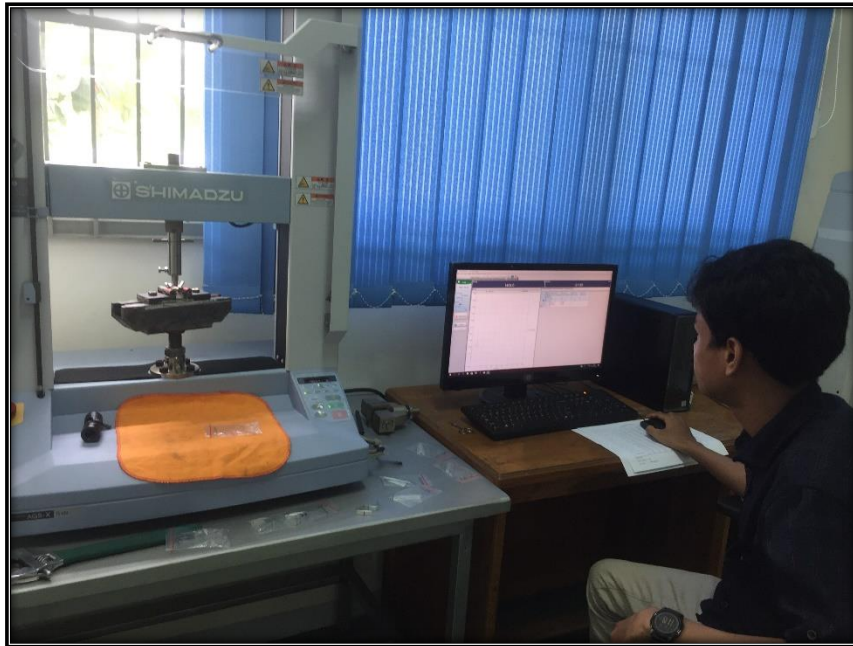
**Gambar A. 16** Kekasaran permukaan aluminium anodisasi pada tegangan 18 volt pada konsentrasi larutan asam sulfat 2,5 molar

**LAMPIRAN II**  
**DOKUMENTASI PENELITIAN**

**Gambar B. 1**  
*Proses Anodizing Aluminium*



**Gambar B. 2**  
Pengujian *Bending*





**Gambar B. 3**  
Uji Kekerasan

