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LAMPIRAN

Lampiran 1. Hasil Uji Tarik spesimen 5% pigment pastes

Nama Spesimen	Lama Perendaman	Lebar (mm)	Tebal (mm)	Luas (mm^2)	Luas (m^2)	Beban (Kg)	Beban (N)	Tegangan (PA)	Tegangan (Mpa)	Panjang mula-mula (mm)	Perpanjangan (ΔL) (mm)	Regangan (€)	Regangan (%)	Modulus Tarik (GPa)	Standar Deviasi Tegangan Tarik (Mpa)	Standar Deviasi Regangan Tarik (%)	Standar Deviasi Modulus Tarik (Gpa)
RPT5-0	0	12.9	4.0	51.7	0.000051740	229.41	2249.76	43501126.26	43.50	50	2.28	0.05	4.55	0.96	0.85	0.34	0.07
RPT5-2	2	11.9	4.2	50.1	0.000050120	247.93	2431.34	48518776.83	48.52	50	2.87	0.06	5.75	0.84	1.52	0.14	0.04
RPT5-4	4	12.1	4.4	53.8	0.000053787	297.84	2920.85	54311957.79	54.31	50	3.38	0.07	6.76	0.80	3.36	0.58	0.02
RPT5-6	6	11.9	4.4	52.9	0.000052907	224.28	2199.45	41561534.96	41.56	50	2.76	0.06	5.51	0.76	1.05	0.52	0.06
RPT5-8	8	12.1	4.3	51.5	0.000051483	210.39	2063.19	40070699.09	40.07	50	2.78	0.06	5.56	0.73	2.02	0.84	0.07
RPT5-10	10	12.0	4.3	51.1	0.000051057	173.35	1700.02	33273459.97	33.27	50	1.54	0.03	3.08	1.08	2.20	0.35	0.07
RPT5-12	12	12.1	4.4	53.1	0.000053093	240.99	2363.27	44512343.46	44.51	50	2.58	0.05	5.15	0.87	2.05	0.37	0.02

Lampiran 2. Hasil Uji tarik spesimen 7,5% pigment pastes

Nama Spesimen	Lama Perendaman	Lebar (mm)	Tebal (mm)	Luas (mm^2)	Luas (m^2)	Beban (Kg)	Beban (N)	Tegangan (PA)	Tegangan (Mpa)	Panjang mula-mula (mm)	Perpanjangan (ΔL) (mm)	Regangan (€)	Regangan (%)	Modulus Tarik (GPa)	Standar Deviasi Tegangan Tarik (Mpa)	Standar Deviasi Regangan Tarik (%)	Standar Deviasi Modulus Tarik (Gpa)
RPT75-0	0	12.0	4.1	49.5	0.000049463	212.85	2087.35	42238173.88	42.24	50	2.04	0.04	4.08	1.06	1.87	0.84	0.17
RPT75-2	2	11.9	4.0	48.0	0.000048013	209.09	2050.47	42943948.46	42.94	50	2.54	0.05	5.07	0.85	4.11	0.37	0.07
RPT75-4	4	11.8	3.8	44.6	0.000044567	198.95	1951.06	43832382.78	43.83	50	2.34	0.05	4.69	0.94	2.76	0.46	0.12
RPT75-6	6	12.1	3.9	47.5	0.000047467	184.03	1804.71	38057927.44	38.06	50	2.20	0.04	4.41	0.87	2.44	0.72	0.09
RPT75-8	8	11.9	4.1	48.9	0.000048917	221.88	2175.93	44551534.80	44.55	50	2.98	0.06	5.96	0.75	1.90	0.26	0.06
RPT75-10	10	11.9	3.8	45.0	0.000044953	144.79	1419.93	31654372.60	31.65	50	1.16	0.02	2.31	1.40	2.97	0.54	0.21
RPT75-12	12	11.9	3.8	45.2	0.000045220	184.79	1812.21	40117402.73	40.12	50	2.10	0.04	4.20	0.96	1.89	0.34	0.07

Lampiran 3. Hasil Uji tarik spesimen 10% pigment pastes

Nama Spesimen	Lama Perendaman	Lebar (mm)	Tebal (mm)	Luas (mm^2)	Luas (m^2)	Beban (Kg)	Beban (N)	Tegangan (PA)	Tegangan (Mpa)	Panjang mula-mula (mm)	Perpanjangan (ΔL) (mm)	Regangan (€)	Regangan (%)	Modulus Tarik (GPa)	Standar Deviasi Tegangan Tarik (Mpa)	Standar Deviasi Regangan Tarik (%)	Standar Deviasi Modulus Tarik (Gpa)
RPT10-0	0	12.2	4.3	52.9	0.000052873	242.32	2376.34	44914298.80	44.91	50	2.42	0.05	4.85	0.93	1.61	0.29	0.02
RPT10-2	2	12.1	4.1	50.2	0.000050150	191.89	1881.84	37543191.49	37.54	50	1.87	0.04	3.74	1.01	3.21	0.40	0.08
RPT10-4	4	12.1	4.1	49.2	0.000049213	208.84	2048.06	41624870.52	41.62	50	2.18	0.04	4.37	0.96	1.62	0.46	0.09
RPT10-6	6	12.5	4.2	52.9	0.000052923	213.92	2097.83	39674703.98	39.67	50	2.82	0.06	5.63	0.71	1.57	0.44	0.04
RPT10-8	8	12.0	4.1	48.7	0.000048667	205.30	2013.27	41349359.04	41.35	50	2.44	0.05	4.87	0.85	0.94	0.46	0.06
RPT10-10	10	11.9	4.0	48.1	0.000048133	196.34	1925.43	40040620.38	40.04	50	2.63	0.05	5.26	0.76	1.42	0.29	0.02
RPT10-12	12	12.0	4.1	49.5	0.000049467	201.99	1980.82	40113296.28	40.11	50	2.66	0.05	5.32	0.76	2.76	0.58	0.03

Lampiran 4. Hasil Uji Bending spesimen 5% pigment pastes

Nama Spesimen	Lama Perendaman	Lebar (b=mm)	Tebal (mm)	Defleks (D) mm	Beban defleksi	P (N)	σf (Mpa)	εf (mm/mm)	momen inersia (mm)	EB		Standar deviasi kekuatan bending (Mpa)	Standar deviasi regangan bending (mm/mm)	Modulus elastisitas bending (Gpa)
										(Mpa)	(Gpa)			
RPB5-0	0	16.1	4.1	9.88	41.10	402.82	146.20	0.0586	93.18	2535.34	2.54	19.02	0.0056	0.21
RPB5-2	2	15.9	4.3	8.19	38.74	379.68	133.43	0.0521	105.49	2894.41	2.89	10.72	0.0128	0.80
RPB5-4	4	16.0	4.2	9.15	36.67	359.39	128.35	0.0563	98.78	2386.61	2.39	19.71	0.0030	0.25
RPB5-6	6	16.0	4.0	9.73	35.67	349.53	129.85	0.0572	87.71	2279.37	2.28	11.40	0.0028	0.07
RPB5-8	8	16.0	4.2	10.02	37.43	366.86	130.91	0.0613	99.10	2232.98	2.23	10.74	0.0017	0.07
RPB5-10	10	16.1	4.1	9.00	31.12	304.95	109.71	0.0540	94.59	2093.04	2.09	21.27	0.0046	0.27
RPB5-12	12	16.0	4.0	10.11	38.86	380.82	141.35	0.0595	87.71	2391.93	2.39	1.80	0.0010	0.04

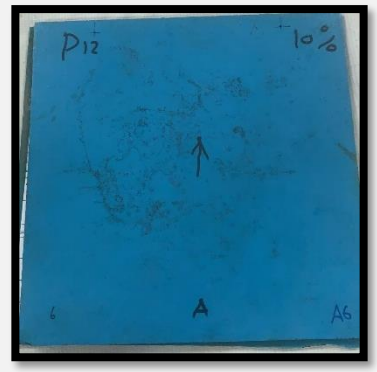
Lampiran 5. Hasil Uji Bending spesimen 7,5% pigment pastes

Nama Spesimen	Lama Perendaman	Lebar (b=mm)	Tebal (mm)	Defleks (D) mm	Beban defleksi	P (N)	σf (Mpa)	εf (mm/mm)	momen inersia (mm)	EB		Standar deviasi kekuatan bending (Mpa)	Standar deviasi regangan bending (mm/mm)	Modulus elastisitas bending (Gpa)
										(Mpa)	(Gpa)			
RPB75-0	0	16.2	4.3	9.48	43.83	429.57	143.95	0.0580	107.64	2692.23	2.69	22.45	0.0028	0.27
RPB75-2	2	16.2	4.3	8.28	32.78	321.23	109.91	0.0514	110.40	2292.00	2.29	5.68	0.0016	0.15
RPB75-4	4	16.0	4.1	9.11	33.17	325.03	118.25	0.0554	94.07	2211.06	2.21	5.84	0.0022	0.13
RPB75-6	6	16.1	4.0	10.10	36.12	354.02	130.74	0.0592	88.31	2217.13	2.22	12.97	0.0041	0.18
RPB75-8	8	16.0	4.0	9.58	35.80	350.85	130.29	0.0564	87.71	2323.48	2.32	7.58	0.0009	0.08
RPB75-10	10	15.8	4.1	9.14	30.28	296.72	110.19	0.0560	91.68	2033.09	2.03	11.21	0.0025	0.14
RPB75-12	12	16.1	4.2	9.78	37.72	369.63	130.17	0.0599	101.82	2286.84	2.29	1.77	0.0015	0.04

Lampiran 6. Hasil Uji Bending spesimen 10% pigment pastes

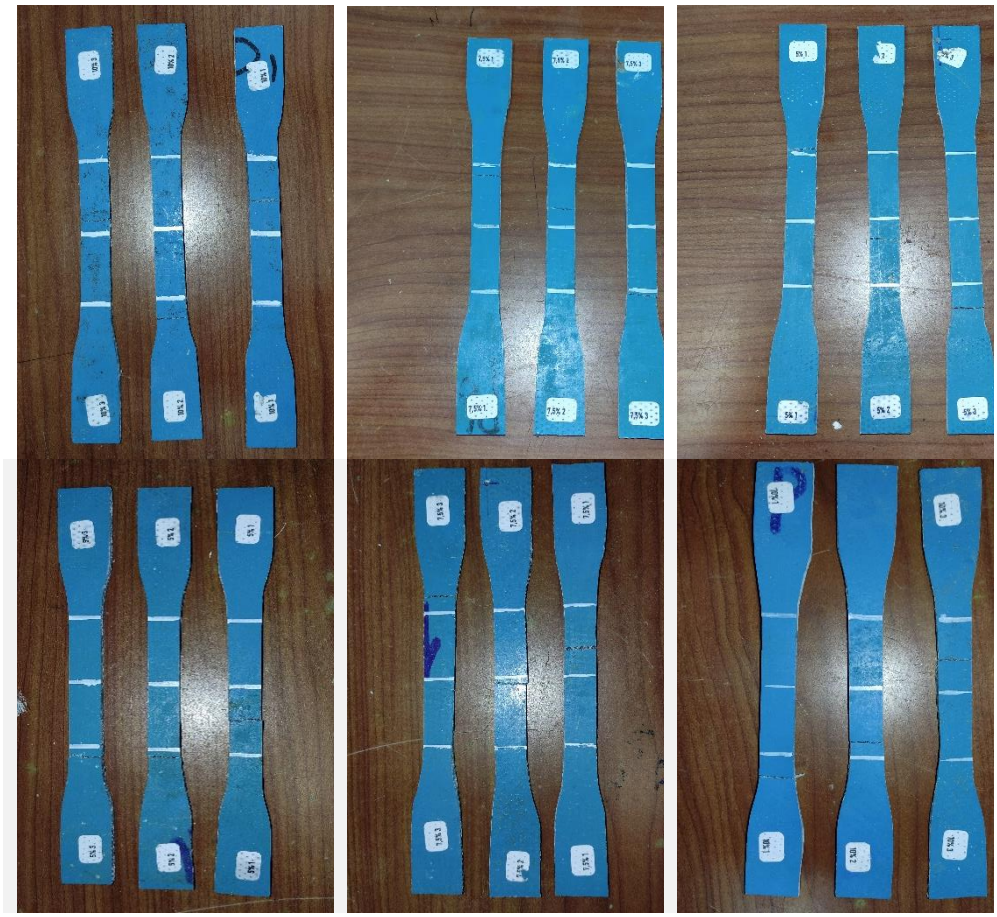
Nama Spesimen	Lama Perendaman	Lebar (b=mm)	Tebal (mm)	Defleks (D) mm	Beban defleksi	P (N)	σf (Mpa)	εf (mm/mm)	momen inersia (mm)	EB		Standar deviasi kekuatan bending (Mpa)	Standar deviasi regangan bending (mm/mm)	Modulus elastisitas bending (Gpa)
										(Mpa)	(Gpa)			
RPB10-0	0	16.0	4.2	9.53	39.26	384.72	137.14	0.0584	98.99	2461.03	2.46	5.49	0.0033	0.03
RPB10-2	2	16.0	4.3	8.40	28.65	280.74	98.50	0.0523	104.03	2004.83	2.00	7.72	0.0027	0.12
RPB10-4	4	15.8	3.8	9.38	31.95	313.07	124.04	0.0538	74.36	2224.20	2.22	20.73	0.0025	0.26
RPB10-6	6	16.0	4.1	9.81	37.27	365.26	133.46	0.0586	92.40	2324.87	2.32	11.43	0.0013	0.13
RPB10-8	8	16.0	4.1	9.15	34.50	338.13	123.77	0.0549	92.03	2306.88	2.31	8.07	0.0010	0.10
RPB10-10	10	16.1	4.2	8.85	30.00	293.97	104.33	0.0538	99.40	2030.49	2.03	4.16	0.0025	0.18
RPB10-12	12	16.1	4.0	9.88	35.18	344.80	127.71	0.0579	87.88	2216.24	2.22	3.00	0.0005	0.03

Lampiran 7. foto panel komposit



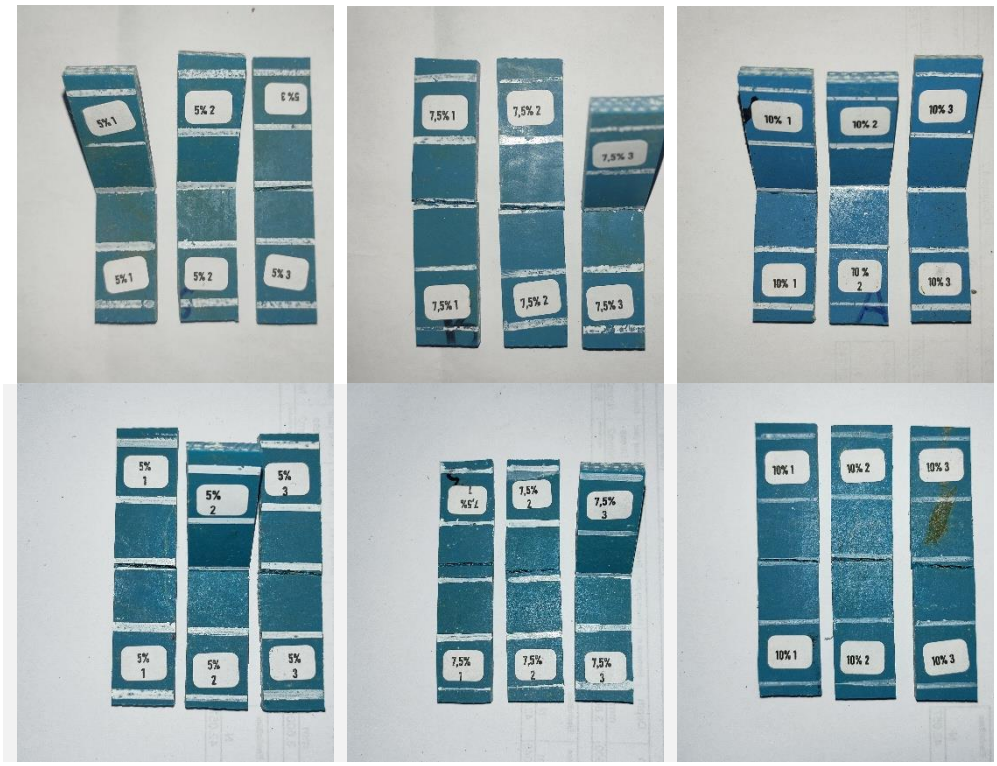
Lampiran 8. Foto spesimen uji tarik sebelum pengujian

Lampiran 9. Foto spesimen uji tarik setelah pengujian



Lampiran 10. Foto spesimen bending sebelum pengujian

Lampiran 11. Foto spesimen bending setelah pengujian



Lampiran 12. ASTM D638 – 02a

Designation: D 638 – 02a

Standard Test Method for Tensile Properties of Plastics[1]

This standard is issued under the fixed designation D 638; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers the determination of the tensile properties of unreinforced and reinforced plastics in the form of standard dumbbell-shaped test specimens when tested under defined conditions of pretreatment, temperature, humidity, and testing machine speed.

1.2 This test method can be used for testing materials of any thickness up to 14 mm (0.55 in.). However, for testing specimens in the form of thin sheeting, including film less than 1.0 mm (0.04 in.) in thickness, Test Methods D 882 is the preferred test method. Materials with a thickness greater than 14 mm (0.55 in.) must be reduced by machining.

1.3 This test method includes the option of determining Poisson's ratio at room temperature.

NOTE 1—This test method and ISO 527-1 are technically equivalent.

NOTE 2—This test method is not intended to cover precise physical procedures. It is recognized that the constant rate of crosshead movement type of test leaves much to be desired from a theoretical standpoint, that wide differences may exist between rate of crosshead movement and rate of strain between gage marks on the specimen, and that the testing speeds specified disguise important effects characteristic of materials in the plastic state. Further, it is realized that variations in the thicknesses of test specimens, which are permitted by these procedures, produce variations in the surface-volume ratios of such specimens, and that these variations may influence the test results. Hence, where directly comparable results are desired, all samples should be of equal thickness. Special additional tests should be used where more precise physical data are needed.

NOTE 3—This test method may be used for testing phenolic molded resin or laminated materials. However, where these materials are used as electrical insulation, such materials should be tested in accordance with Test Methods D 229 and Test Method D 651.

NOTE 4—For tensile properties of resin-matrix composites reinforced with oriented continuous or discontinuous high modulus >20-GPa (>3.0 × 10^6-psi) fibers, tests shall be made in accordance with Test Method D 3039/D 3039M.

1.4 Test data obtained by this test method are relevant and appropriate for use in engineering design.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 229 Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation[2]

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension[3]

D 618 Practice for Conditioning Plastics for Testing[4]

D 651 Test Method for Tensile Strength of Molded Electrical Insulating Materials[5]

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting[4]

D 883 Terminology Relating to Plastics[4]

D 1822 Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials[4]

D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials[6]

D 4000 Classification System for Specifying Plastic Materials[7]

D 4066 Classification System for Nylon Injection and Extrusion Materials[7]

D 5947 Test Methods for Physical Dimensions of Solid Plastic Specimens[8]

E 4 Practices for Force Verification of Testing Machines[9]

E 83 Practice for Verification and Classification of Extensometer[9]

E 132 Test Method for Poisson's Ratio at Room Temperature[9]

E 691 Practice for Conducting an Interlaboratory Study to

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

Current edition approved November 10, 2002. Published January 2003. Originally approved in 1941. Last previous edition approved in 2002 as D 638 – 02.

[2] *Annual Book of ASTM Standards*, Vol 10.01.
[3] *Annual Book of ASTM Standards*, Vol 09.01.
[4] *Annual Book of ASTM Standards*, Vol 08.01.
[5] Discontinued; see *1994 Annual Book of ASTM Standards*, Vol 10.01.
[6] *Annual Book of ASTM Standards*, Vol 15.03.
[7] *Annual Book of ASTM Standards*, Vol 08.02.
[8] *Annual Book of ASTM Standards*, Vol 08.03.
[9] *Annual Book of ASTM Standards*, Vol 03.01.

*A Summary of Changes section appears at the end of this standard.

Lampiran 13. ASTM D 790 - 02

Designation: D 790 – 02

Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[1]

This standard is issued under the fixed designation D 790; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 These test methods cover the determination of flexural properties of unreinforced and reinforced plastics, including high-modulus composites and electrical insulating materials in the form of rectangular bars molded directly or cut from sheets, plates, or molded shapes. These test methods are generally applicable to both rigid and semirigid materials. However, flexural strength cannot be determined for those materials that do not break or that do not fail in the outer surface of the test specimen within the 5.0 % strain limit of these test methods. These test methods utilize a three-point loading system applied to a simply supported beam. A four-point loading system method can be found in Test Method D 6272.

1.1.1 *Procedure A*, designed principally for materials that break at comparatively small deflections.

1.1.2 *Procedure B*, designed particularly for those materials that undergo large deflections during testing.

1.1.3 Procedure A shall be used for measurement of flexural properties, particularly flexural modulus, unless the material specification states otherwise. Procedure B may be used for measurement of flexural strength only. Tangent modulus data obtained by Procedure A tends to exhibit lower standard deviations than comparable data obtained by means of Procedure B.

1.2 Comparative tests may be run in accordance with either procedure, provided that the procedure is found satisfactory for the material being tested.

1.3 The values stated in SI units are to be regarded as the standard. The values provided in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—These test methods are not technically equivalent to ISO 178.

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics for Testing[2]
D 638 Test Method for Tensile Properties of Plastics[2]
D 883 Terminology Relating to Plastics[2]
D 4000 Classification System for Specifying Plastic Materials[3]
D 5947 Test Methods for Physical Dimensions of Solid Plastic Specimens[4]
D 6272 Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials by Four-Point Bending[4]
E 4 Practices for Force Verification of Testing Machines[5]
E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[6]

3. Terminology

3.1 *Definitions*—Definitions of terms applying to these test methods appear in Terminology D 883 and Annex A1 of Test Method D 638.

4. Summary of Test Method

4.1 A bar of rectangular cross section rests on two supports and is loaded by means of a loading nose midway between the supports (see Fig. 1). A support span-to-depth ratio of 16:1 shall be used unless there is reason to suspect that a larger span-to-depth ratio may be required, as may be the case for certain laminated materials (see Section 7 and Note 8 for guidance).

4.2 The specimen is deflected until rupture occurs in the outer surface of the test specimen or until a maximum strain (see 12.7) of 5.0 % is reached, whichever occurs first.

4.3 Procedure A employs a strain rate of 0.01 mm/mm/min (0.01 in./in./min) and is the preferred procedure for this test method, while Procedure B employs a strain rate of 0.10 mm/mm/min (0.10 in./in./min).

[1] These test methods are under the jurisdiction of ASTM Committee D20 on Plastics and are the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

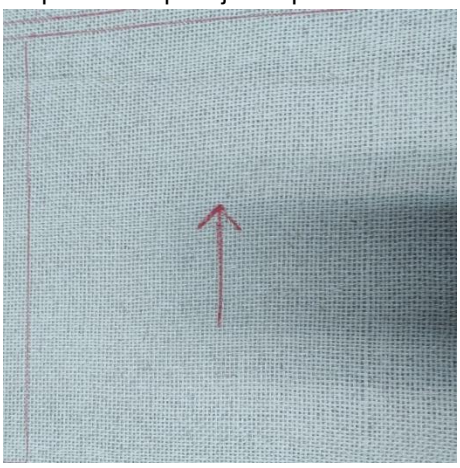
Current edition approved April 10, 2002. Published June 2002. Originally published as D 790 – 70. Last previous edition D 790 – 00.

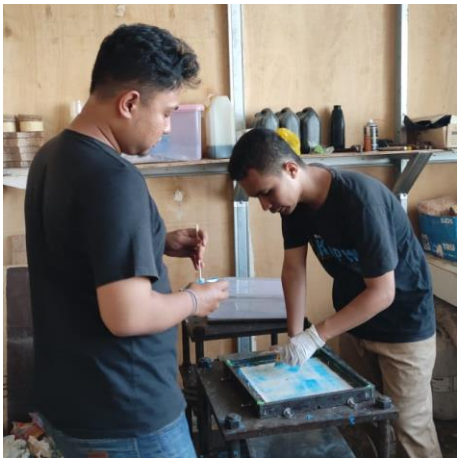
[2] *Annual Book of ASTM Standards*, Vol 08.01.
[3] *Annual Book of ASTM Standards*, Vol 08.02.
[4] *Annual Book of ASTM Standards*, Vol 08.03.
[5] *Annual Book of ASTM Standards*, Vol 03.01.
[6] *Annual Book of ASTM Standards*, Vol 14.02.

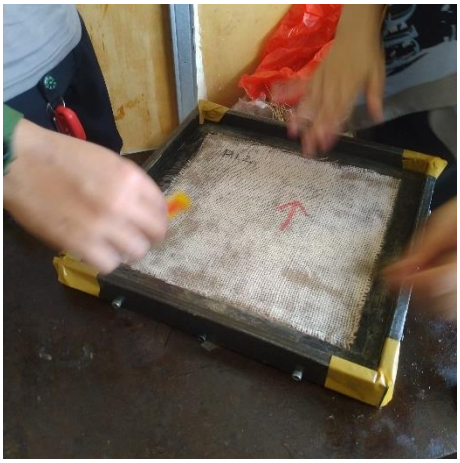
***A Summary of Changes section appears at the end of this standard.**

Lampiran 14. Foto kegiatan penelitian

1. Proses pembuatan panel sampel uji komposit







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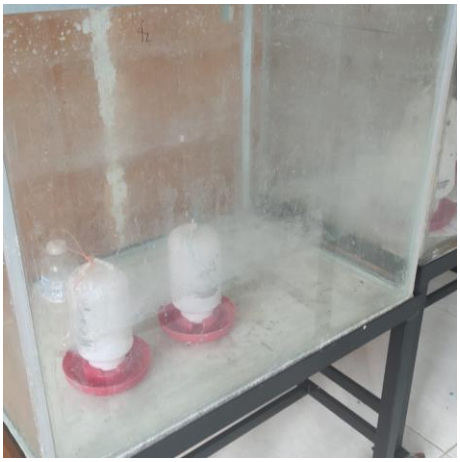
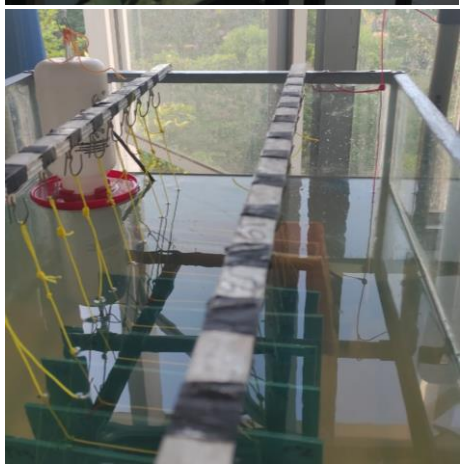
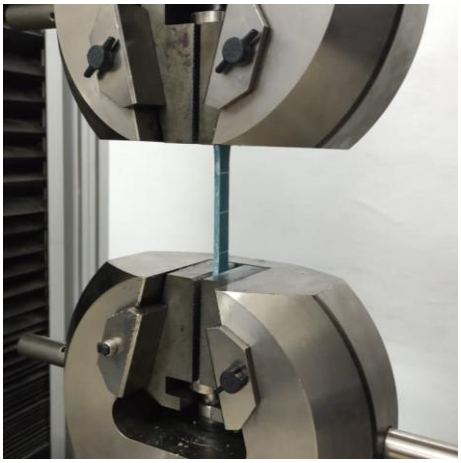
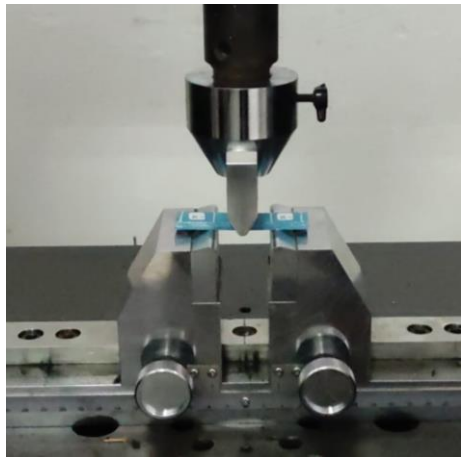




3. Proses pengujian




TENSILON



KOMENTAR DAN KOREKSI

Dosen Penguji	Pertanyaan	Jawaban	Paraf
Dr. Ir. Hairul Arsyad, ST., MT	Apa penyusun komposit?	Penyusun komposit terdiri dari matriks dan penguat seperti serat, keramik, karet dan logam.	
	Mengapa disebut penguat?	Karena dalam komposit penguat membawa atau menerima beban sebesar 70% - 90%.	
	Bagaimana system transfer beban dari matriks ke penguat?	Beban diterima oleh matriks, kemudian didistribusikan kepada penguat.	
Dr. Eng Lukmanul Hakim Arma, ST., MT	Apakah pigment pastes dapat bercampur dengan air?	Pigment pastes Tidak dapat bercampur dengan air.	
	Mengapa panel komposit yang ditambahkan pigment pastes dapat bertambah berat?	resin epoxy dapat menyerap air karena molekul air bereaksi dengan ikatan kimia dalam epoxy atau biasa disebut proses hidrolisis.	