UTM(Universal Testing Machine)

1.

, stress-strain
.

(load) (tensile), (flexural),
(compression), (shear) ,
(tensile stress), (tensile strain), (flexural
stress), (flexural modulus) ,
.

2.

UTM .
LOAD LOAD .
, ,
LOAD
.

.

. ASTM(American Society for Testing
and Materials) . size
ASTM .

* ASTM (American Society for Testing and Materials)

1.

, Test Standards
Maker User 1898
. 1995 committee 132 9500

Standards   .   (Philadelphia, USA)

                                   36000

Committee   .

2.

(1)   .

A : Ferrous Metals(Casting   Nonferrous Metals   'A'   )
B : Nonferrous Metals
C : Cementifious, Ceramic, Concreate and Masonry Materials
D : Miscellaneos Materials
E : Miscellaneous Subjects
F : Materials for Specific Applications
G : Corrosion, Deterioration, and Degradation of Materials
ES : Emergency Standards
P : Proposals

                        '- '   Old   New   .   ,   (,
1   )   a, b, c   (95a)
             .

                   '- '   (   )   [C584-81(1988)]   (
    1981   )   .   '- '
                2(epsilon one or two)   editorial
                    .

        ASTM   JIS   DIN

             .

(2)   :   inch-pound Units   Metric
Units   Standard   .
    , A128M(,   M   .)

(3)   : Section XX   Index   .

, A364 Discontinued - Replaced by A 434

*ASTM

http://polybase.polymersnet.com/Technicalinfo/Rule.asp

2.1

LOAD   .

Fig..1

Jig
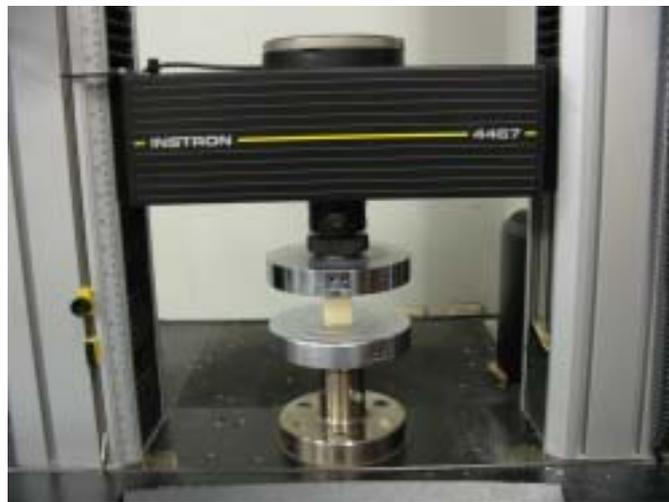
.   ASTM

(   )   LOAD   CELL

.   ,

,   kg/cm^3 Pa

2.2 (Tensile Test)

Fig..2

Jig (ASTM etc.)

.

(tensile strain) (tensile stress) .

( ) L_0

( ) L = L/L_0 ,

. ( )

, kg/cm^3

Pa .

-

- 23 , 50% , 24
  conditioning .

- (: mm)

	0.28		0.28~0.55	0.16	
	Type-1	Type-2	Type-3	Type-4	Type-5
W	0.5	0.25	0.75	0.25	0.125
S	2.25	2.25	2.25	1.3	0.375
WO	0.75	0.75	1.13	0.75	0.375
LO	6.5	7.2	9.7	4.5	2.5
G	2	2	2	1	0.3
D	4.5	5.3	4.5	2.5	1
R	3	3	3	0.56	0.5
RO				1	

		(mm/min)
	Type-1, 2, 3 rod, tube	5, 50, 500
	Type-4	5, 50, 500
	Type-5	1, 10, 100
	Type-3	50, 500
	Type-4	50, 500

: ASTM D638, ASTM D420, DIN 53455

2.3

Fig..3

.

3-point bending

kg/cm³   Pa   .

$$\sigma = \frac{3PL}{2bd^2}$$

(P: , L: support span   , b: , d:)

-

.

- 　　　　　(Flexural Strength) :
　　load　　　　　　　　　　　　　　load　　　　　.
- 　　　　　(Flexural Modulus) :　　　　　　　　　load
　　　　　　　　　　　　　.

(http://www.cheric.org)

-

•

		L/D											
		L/D = 16 to 1			L/D = 32to 1			L/D = 40to 1			L/D = 60 to 1		
1/32	1	2	5/8	0.02	2	1	0.05	2.25	1.25	0.08	2.38	1.88	0.19
1/16	1	2	1	0.03	3	2	0.11	3.5	2.5	0.17	4.88	3.75	0.37
3/32	1	2.5	1.5	0.04	4	3	0.16	4.75	3.75	0.25	7.28	5.63	0.56
1/8	1	3	2	0.05	5	4	0.21	7	5	0.33	9.75	7.5	0.74
3/16	0.5	4	3	0.08	7.5	6	0.32	9.5	7.5	0.5	14.6	11.3	1.12
1/4	0.5	5	4	0.11	10	8	0.43	13	10	0.67	19.5	15	1.49
3/8	0.5	7.5	6	0.16	15	12	0.64	19	15	1	29.3	22.5	2.24
1/2	0.5	10	8	0.21	19.5	16	0.85	25	20	1.34	39	30	3
3/4	0.75	15	12	0.32	29	24	1.28	37	30	2	58.5	45	4.49
1	1	19.5	16	0.43	39	32	1.71	49	40	2.67	78	60	5.98

: ASTM D790, DIN 53457, JIS K6301

3.

　UTM　　　　　load　　　detect　　cell　　control board　　cell　　　　load
　　　　strength　　　　　　computer, cell　　　　　　main body
.

3.1 CELL

　UTM
　load
.
　　　　　　loading direction　　　cell
　　　　　　　　　,
loading direction　　　cell　　　　　　.
　Cell　　　　　　　　　　load
　　　　,
　30KN　　　cell　　　　.

Fig. 4. Cell (Instron)

3.2 CONTROL BOARD

　UTM　main-body　　　　　　,
　　　　cell　loading　1
　　　.
cell　　　　　　　load
extension　　　　.

　　　　,　,

control board　　　　　　.

Fig. 5. Control Board

3.3 COMPUTER

Cell   load

.

.   ,   ,

,   ,   loading speed,   load

extension   ,   data   (strength, modulus, strain   ..)

.

data

. (Instron   data

calculation   screen   printer   ,

screen   screen   , printer

text   *.rep   data   .)

,   manual

.

data   ,

x   y   .

x   y   scale   , autoscale

scale   .   scale

.

UTM   load   .   ,

load   .

threshold   .   threshold   load

,   .

test   limits   .

(Instron   (end sample   )   *.rep

,   *.rep   text file   word   . (

))

(Instron   3   .

*.rep : text file

*.mrd :   Instron   .

*.mad :   load   . (dimension   ))

4.

1.   .

Fig..6

2.   .

Fig..7

3.   .

5.

5.1

Fig.8. Compression Test
Specimen
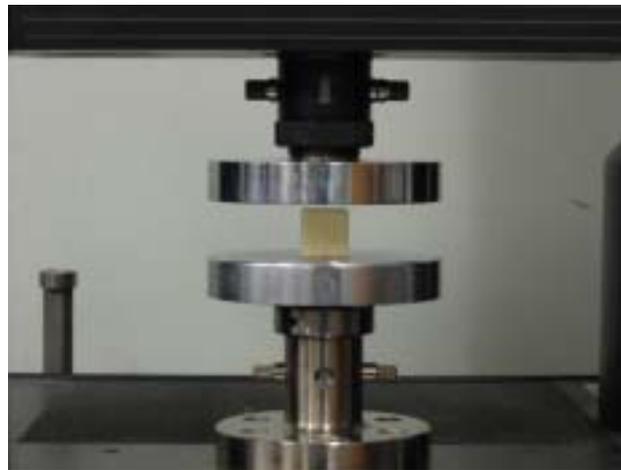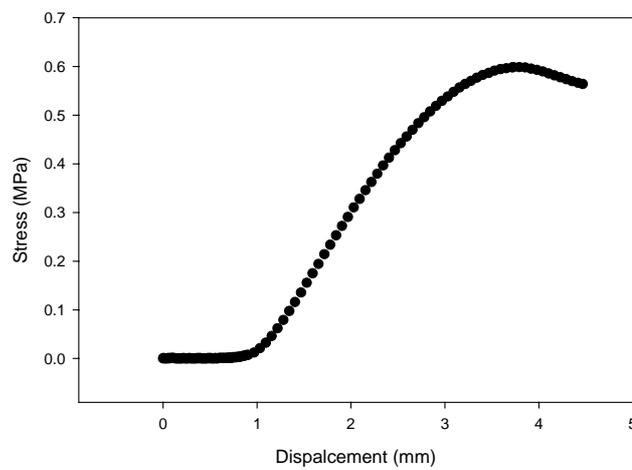
Fig. 9. Compression Test

Graph.1 Compression Test

Compression Test   (strain)   stress
                    0~1mm   stress
Jig   .   3~4mm
maximum   maximum   .
maximum

                                                    compression test   maximum
              .

5.2

Fig..10 Tensile Test
Specimen
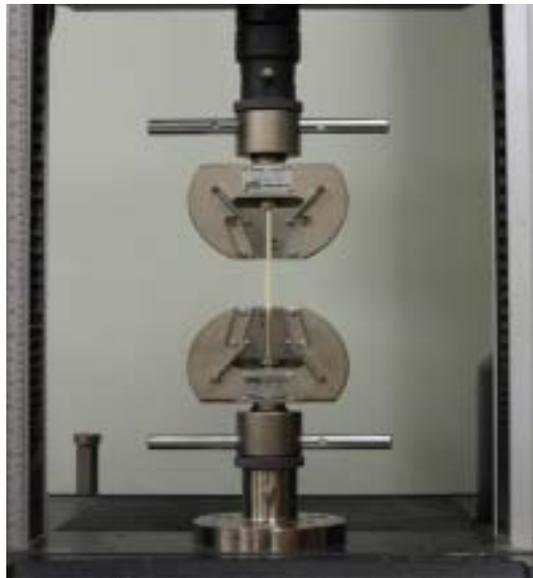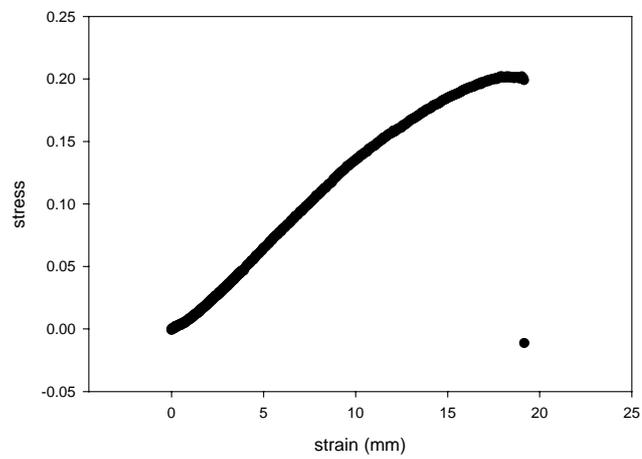
Fig..11 Tensile Test

Graph.2 Tensile Test

Tensile Test   (strain)   stress

15~20mm   maximum   .

maximum   stress

.

(http://www.cheric.org)

5.3 Flexure Test

Fig.12. Flexure Test
specimen
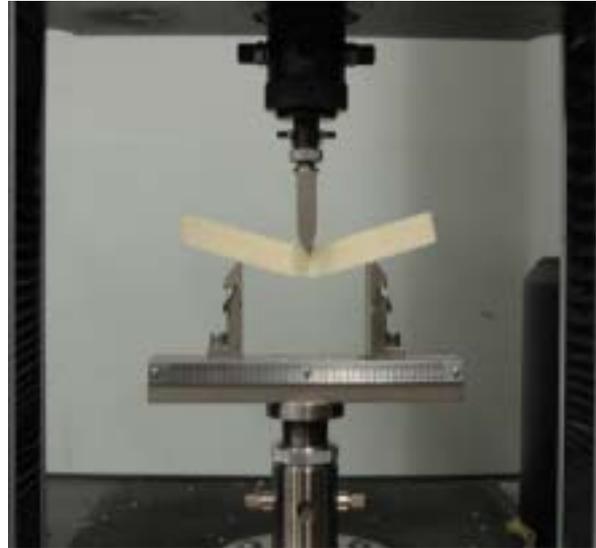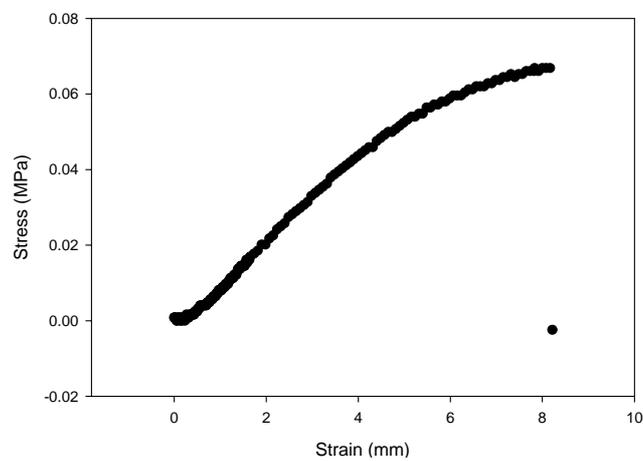
Fig.13. Flexure Test

Graph.3 Flexure Test

flexure test (strain) stress 7~9mm maximum .

maximum stress .