

Two Newly Developed Environment-friendly Boron-free Fiberglass E6-CR and E7



Dr. Heinz Zhang
Product R & D Center

巨石集团有限公司
JUSHI GROUP CO., LTD.



目录 Overview



Jushi Fiberglass

**E7(ViPro)
Fiberglass**

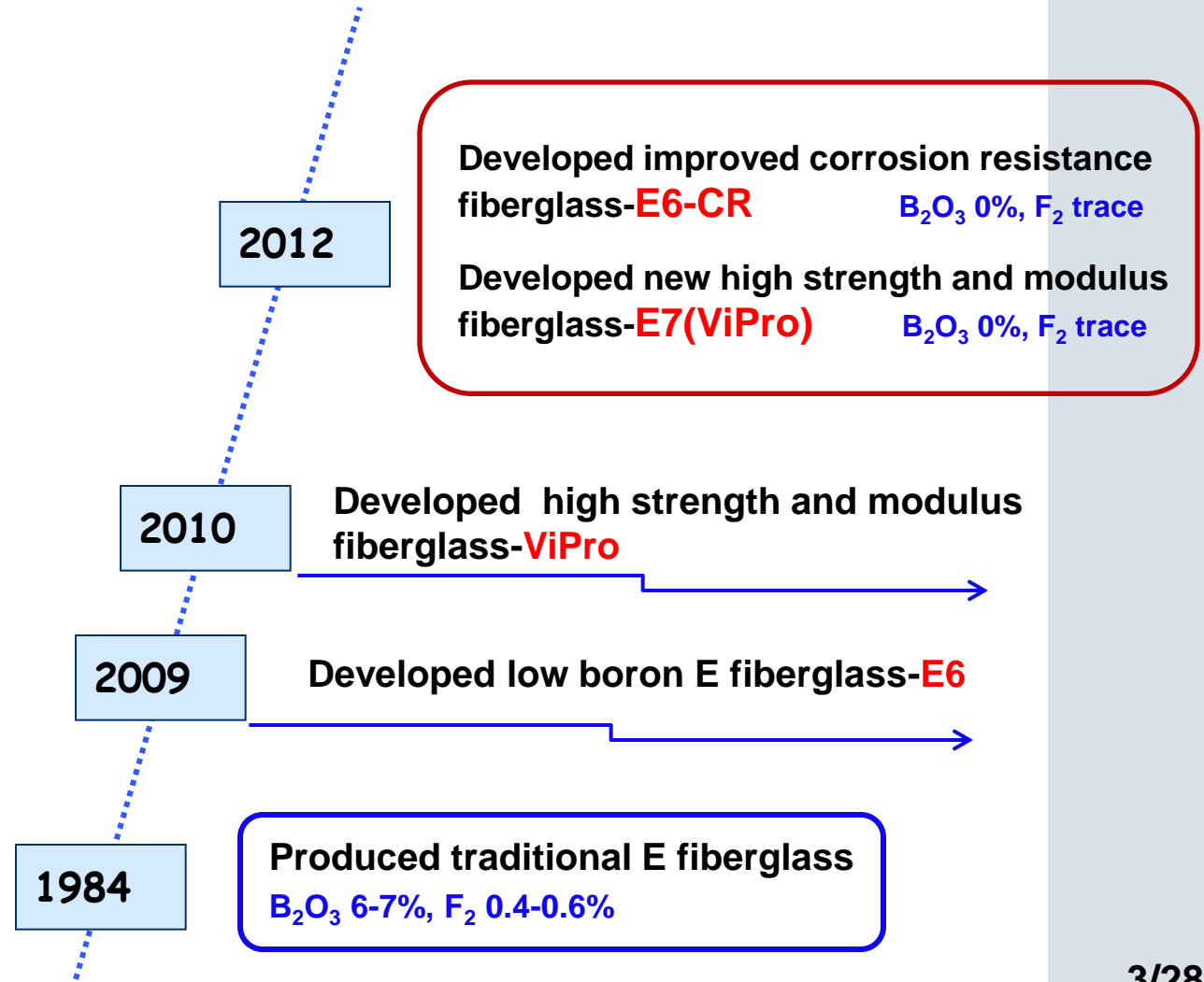
**E6-CR
Fiberglass**



Jushi Fiberglass



History of Jushi Fiberglass:





目录 Overview



Jushi Fiberglass

**E7(ViPro)
Fiberglass**

**E6-CR
Fiberglass**



E6-CR Fiberglass

ASTM D578-00

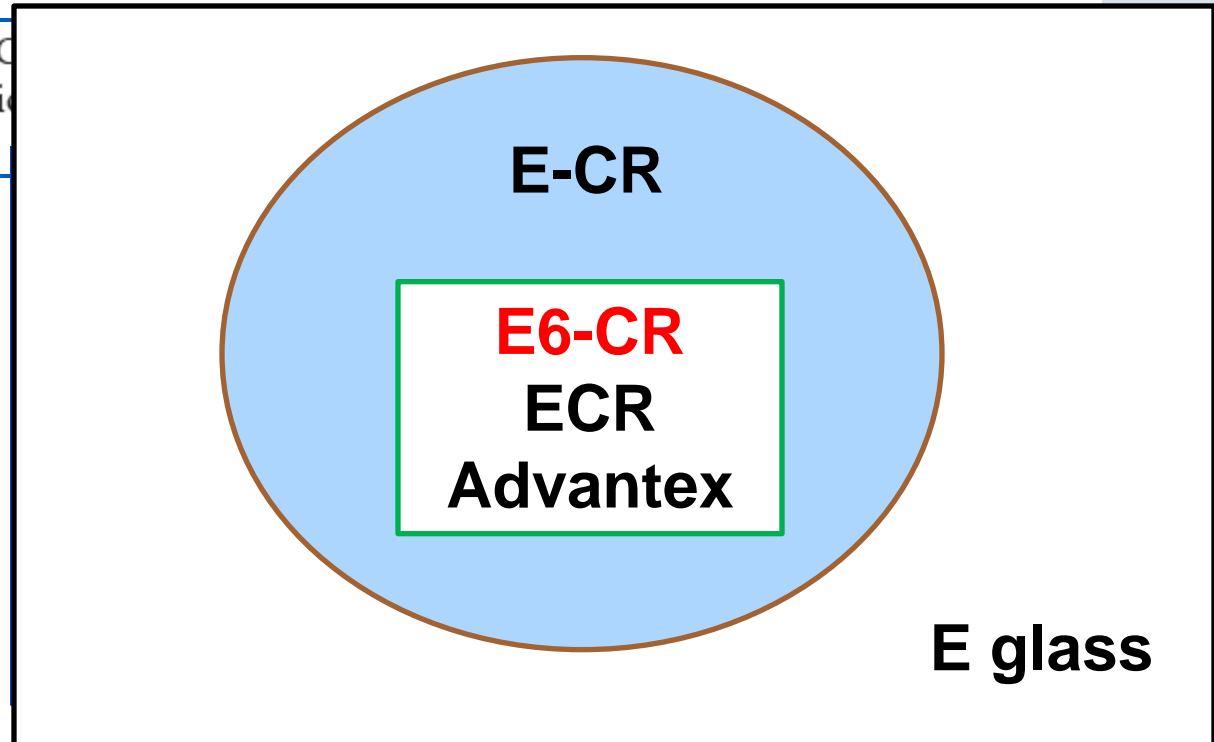
ISO 2078-93

4.2.4 The nomenclature “E-CR” free modified E-Glass composite corrosion by most acids.

What is E6-CR fiberglass?

=Boron-free E glass

=E-CR glass





E6-CR Fiberglass

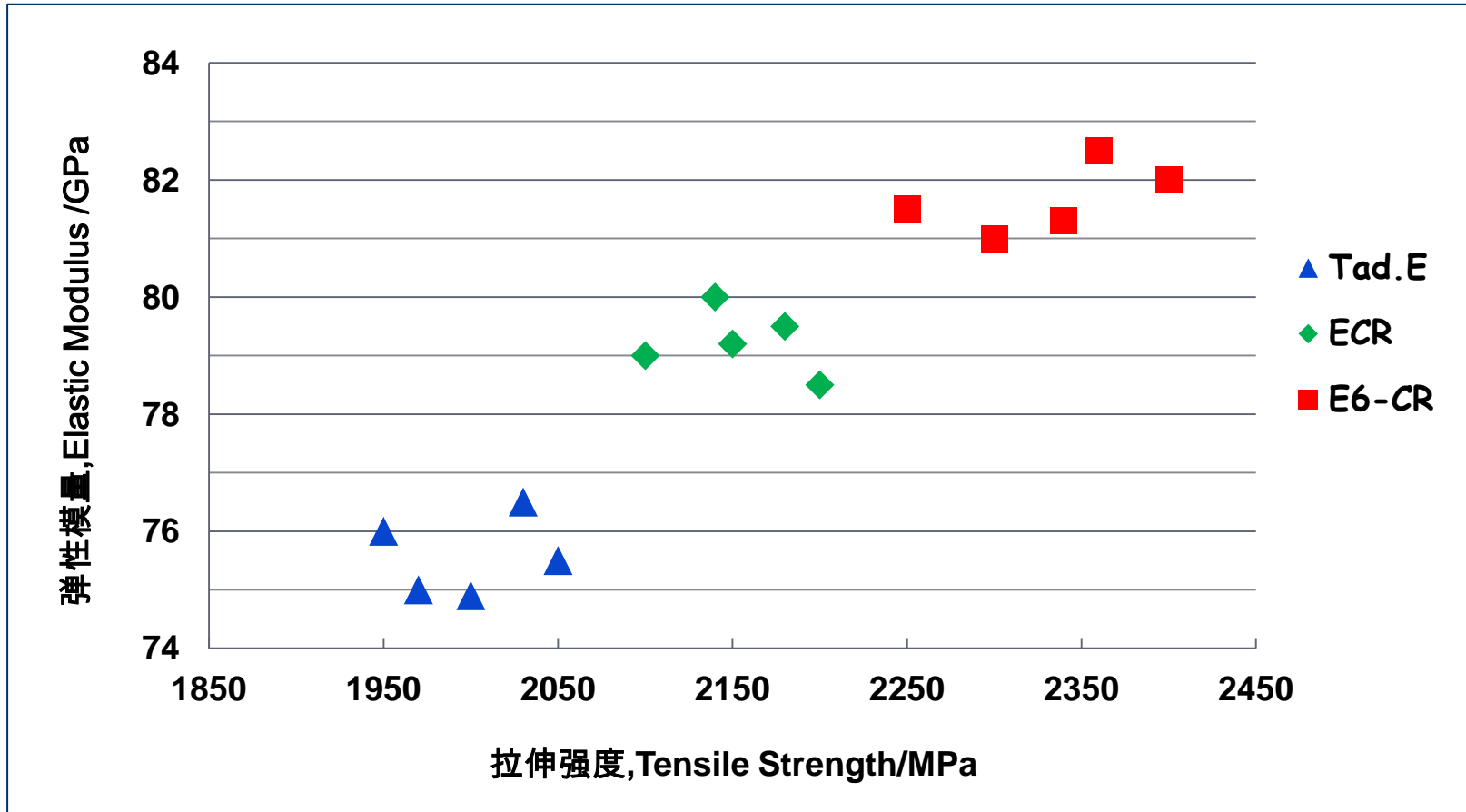
1. The contrast with physical properties of typical fiberglass:

Items	Method	Unit	E6-CR	Tad.E	ECR
Density	ASTM1505	g/cm ³	2.65	2.60	2.66
Refractive Index	Immersion	/	1.566	1.566	1.576
Expansion Coefficient	ASTM696	10 ⁻⁶ K ⁻¹	5.98	5.96	5.90
Permittivity	ASTMD150	/	7.0	6.7	7.2
Transition Temperature	ASTMC338	°C	902	842	900



E6-CR Fiberglass

2. Mechanical properties of E6-CR fiberglass



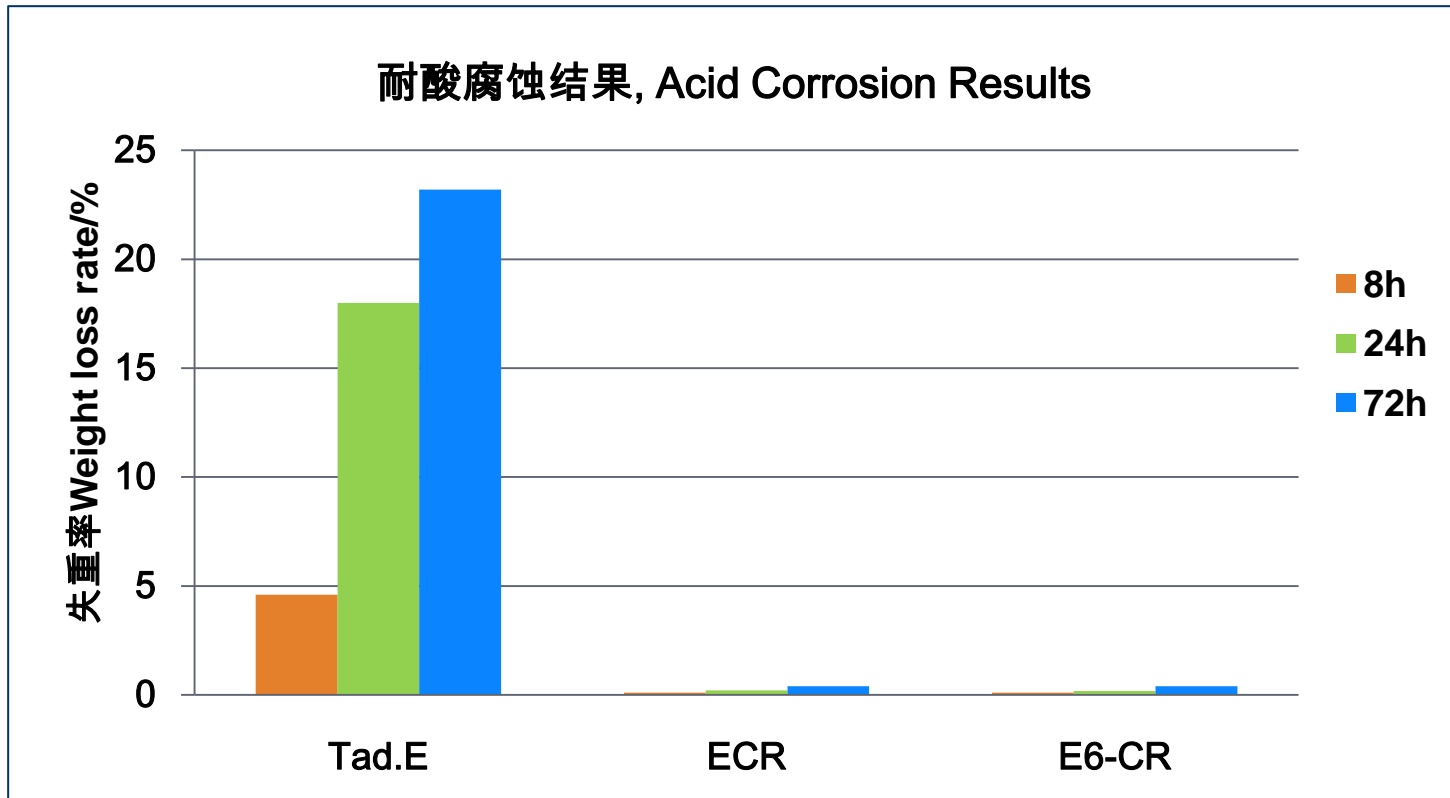
Note: the mechanical properties of impregnated yarn are tested by ASTM2343 standard.



E6-CR Fiberglass

3. Corrosion resistance of E6-CR fiberglass

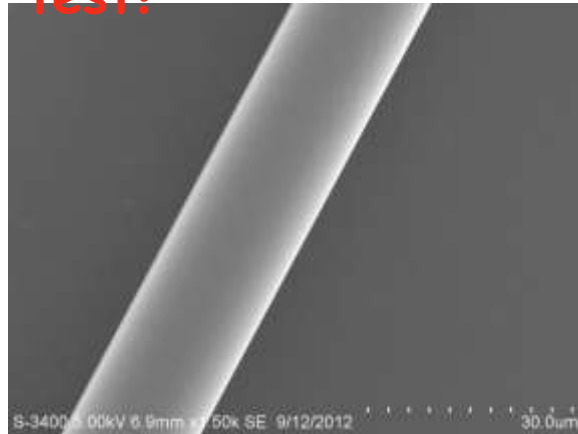
(1) Hydrochloric acid test:
23°C, 10%HCl, different soak time.



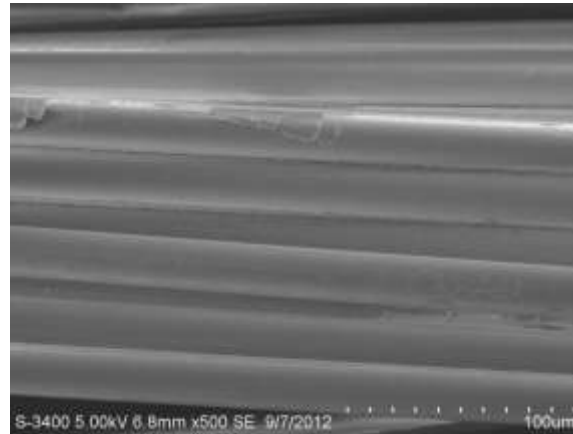


E6-CR Fiberglass

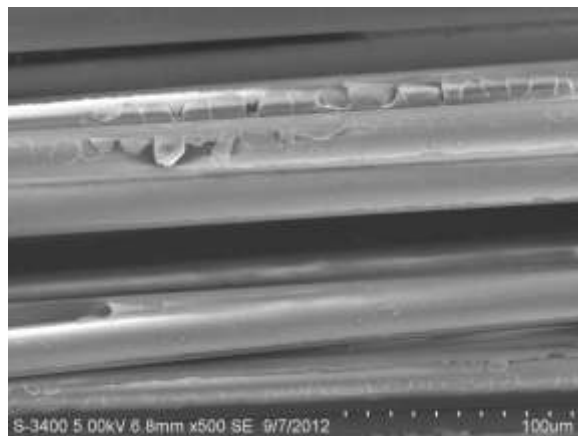
Micrographs of Tad.E fiberglass hydrochloric acid test:



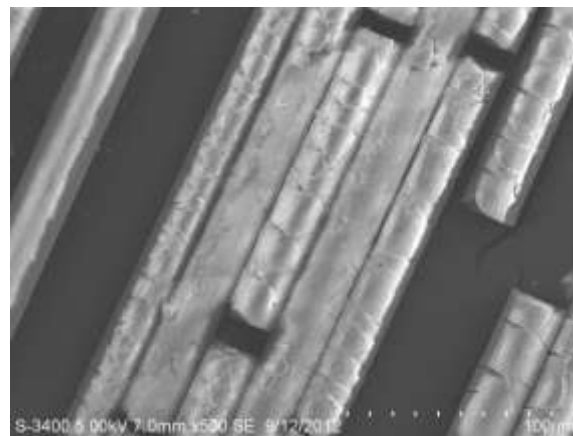
original sample



corrosion 8h



corrosion 24h



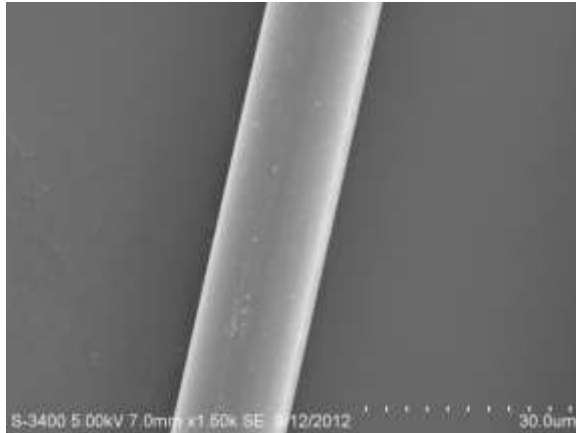
corrosion 72h

Tad.E

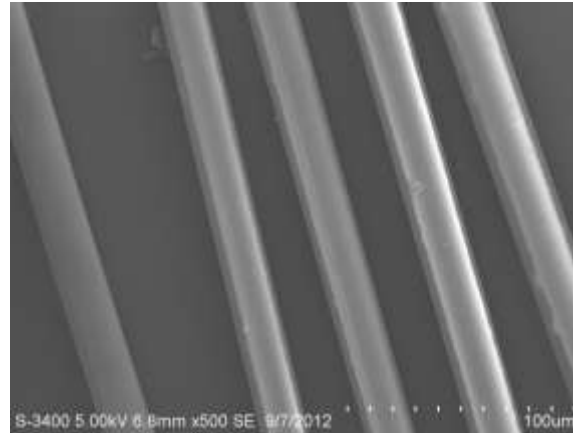


E6-CR Fiberglass

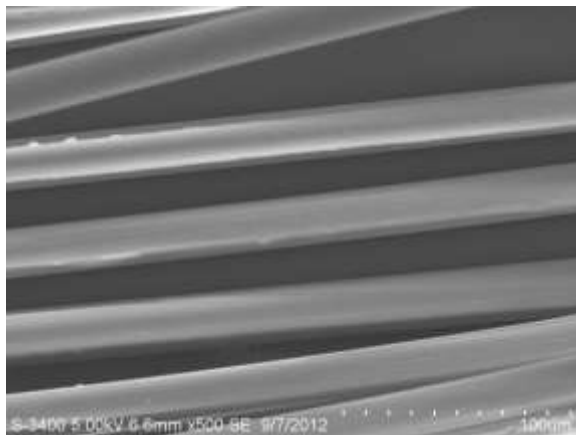
Micrographs of E6-CR fiberglass hydrochloric acid test:



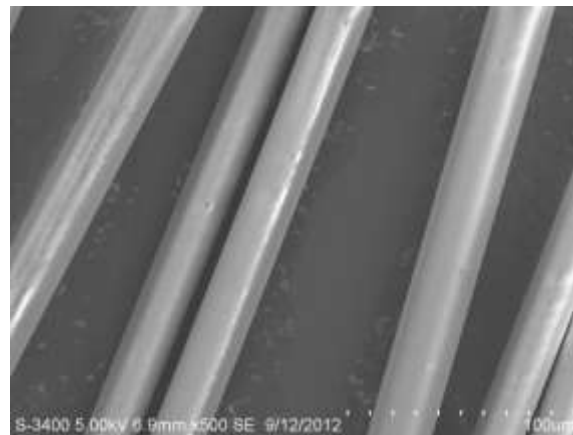
original sample



corrosion 8h



corrosion 24h



corrosion 72h

E6-CR

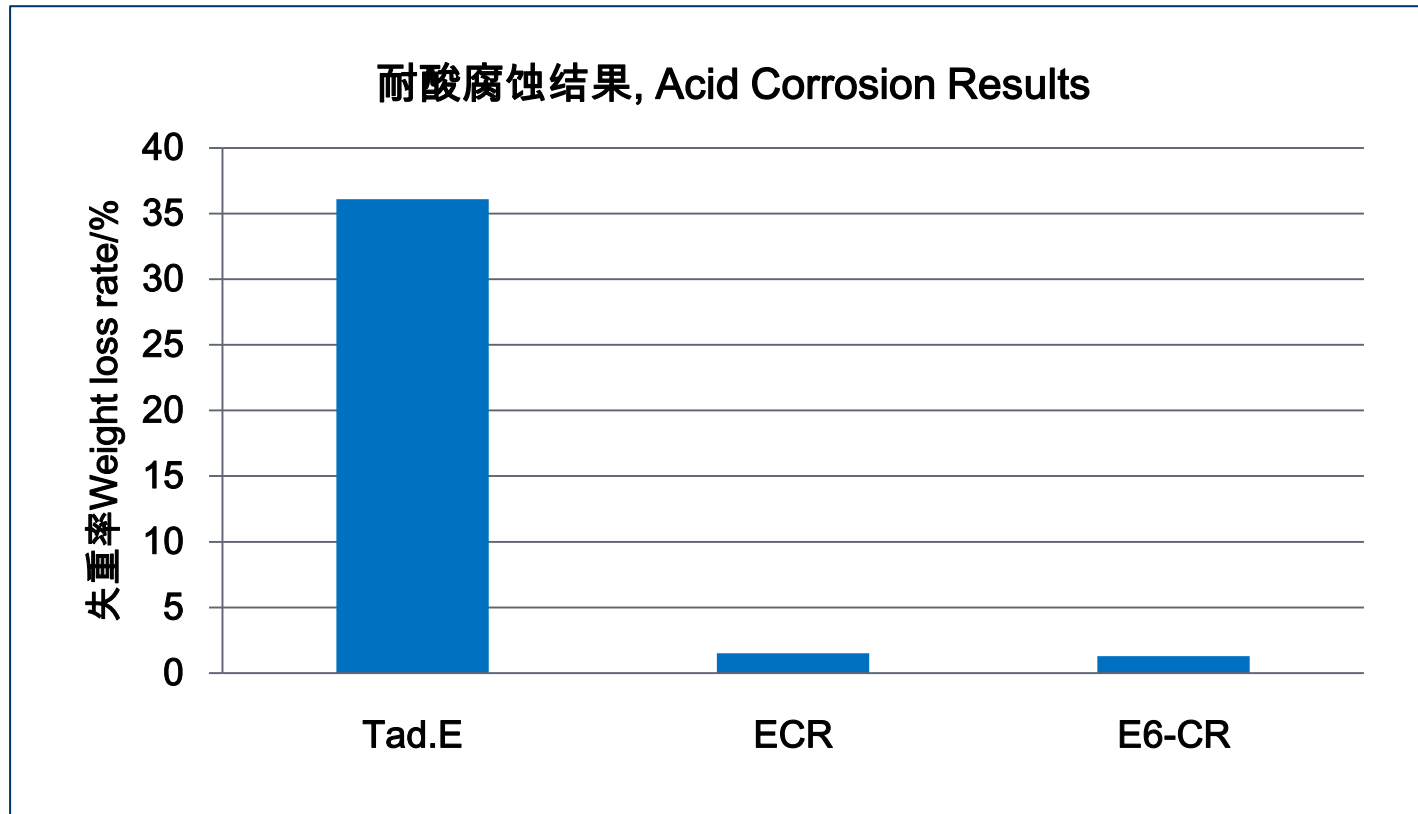


E6-CR Fiberglass

3. Corrosion resistance of E6-CR fiberglass

(2) Sulfuric acid test:

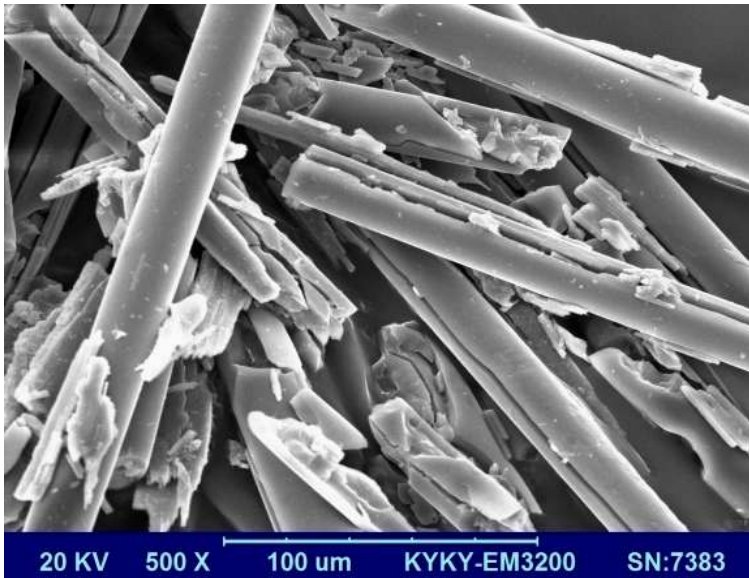
96°C, 10% H_2SO_4 , soak time 24h.



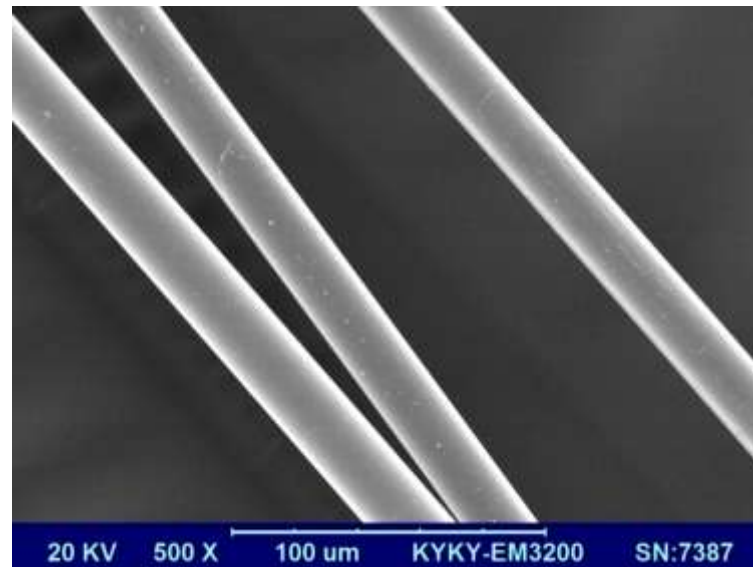


E6-CR Fiberglass

Micrographs of Tad.E and E6-CR fiberglass hydrochloric acid test:



Tad.E



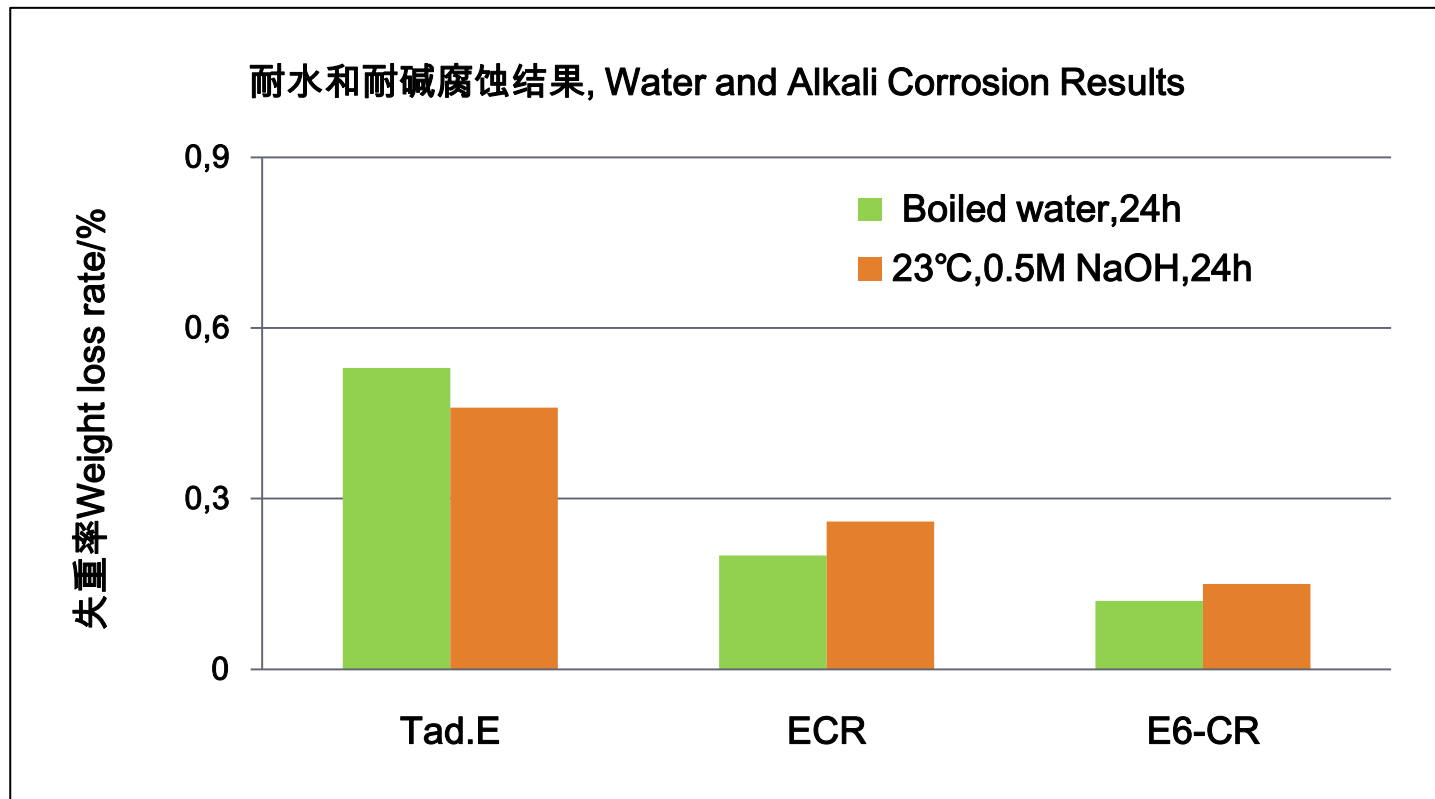
E6-CR



E6-CR Fiberglass

3. Corrosion resistance of E6-CR fiberglass

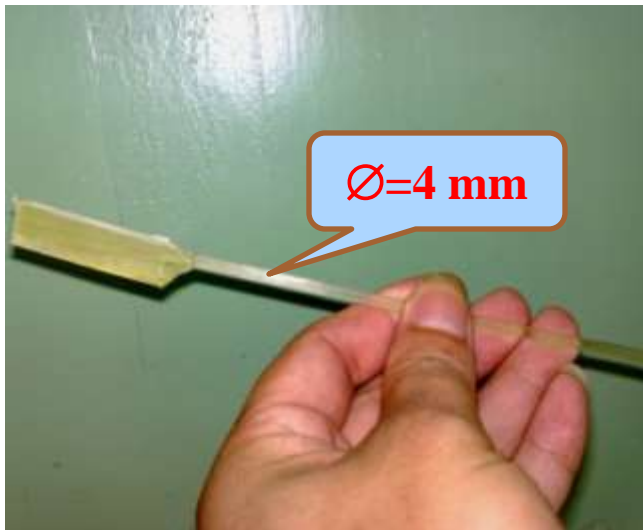
- (3) Water and alkali test:
Boiled water, soak time 24h.
23°C, 0.5M NaOH, soak time 24h.





E6-CR Fiberglass

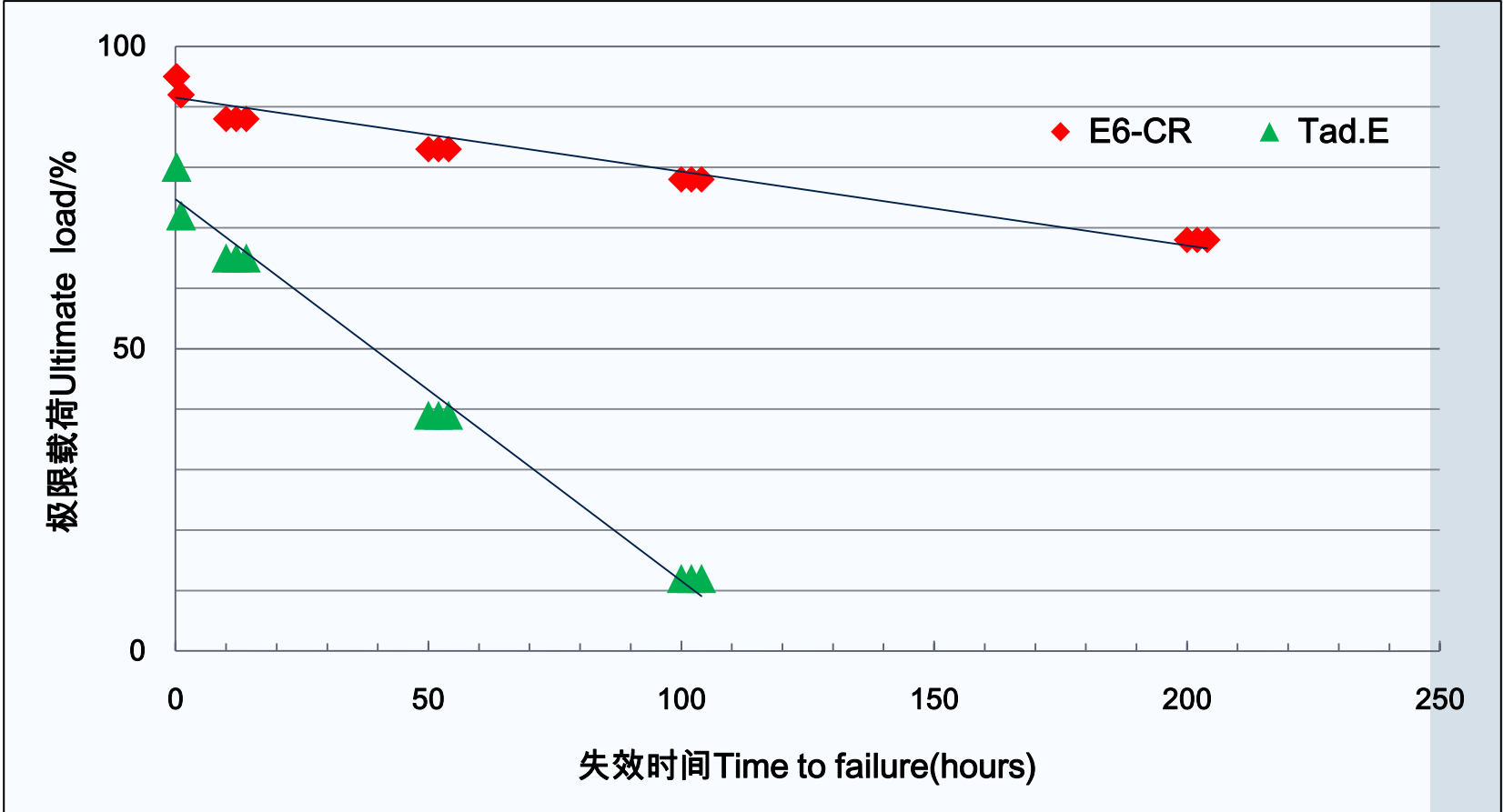
4. Stress corrosion test of E6-CR fiberglass





E6-CR Fiberglass

4. Stress corrosion property of E6-CR fiberglass





E6-CR Fiberglass

The essential reason of excellent performance: glass composition

Composition	E6-CR	Tad.E	ECR
SiO ₂	59-61	52-55	56-60
Al ₂ O ₃	13-15	12-14	11-13
CaO	22-25	22-25	19-23
MgO	0.5-1	<0.5	1.5-4
B₂O₃	0	5-7	0
F₂	trace	0.5-1	trace
TiO₂	<0.6	<0.6	2-4
ZnO	0	0	1-4
Li₂O	<0.3	0	0
Na ₂ O+K ₂ O	<0.8	<1	<2



E6-CR Fiberglass

Outstanding characteristics summary of E6-CR fiberglass.

2

Extremely excellent corrosion resistance solution for composite.

1

Accord with EU REACH rule, belong to boron-free fiberglass.

3

Excellent mechanical properties.

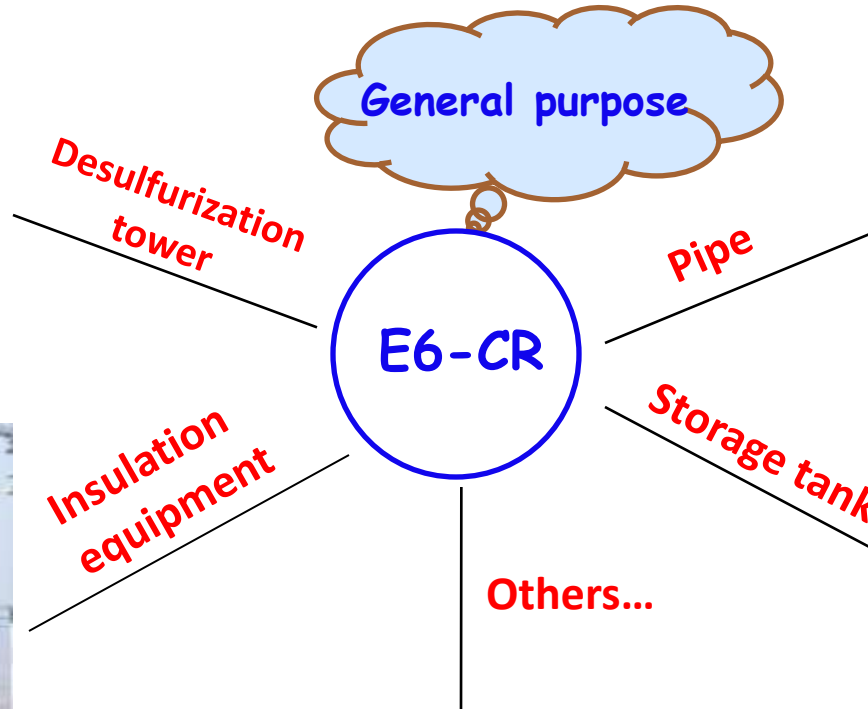
4

Realized large-scale production, belong to cost-effective product.



E6-CR Fiberglass

Typical Application Fields





目录 Overview



Jushi Fiberglass

**E7(ViPro)
Fiberglass**

**E6-CR
Fiberglass**



E7 Fiberglass

ISO 2078-93

What is E7(Vipro) fiberglass?

- = ViPro glass
- = Boron-free glass
- = High strength and modulus R glass

Table 1

Type	General indications
E	for general purposes; good electrical properties
D	good dielectric properties
A	high alkali content
C	chemical resistance
S	high mechanical strength
R	high mechanical strength
AR	alkali resistant
E-CR	for use in acid environments





E7 Fiberglass

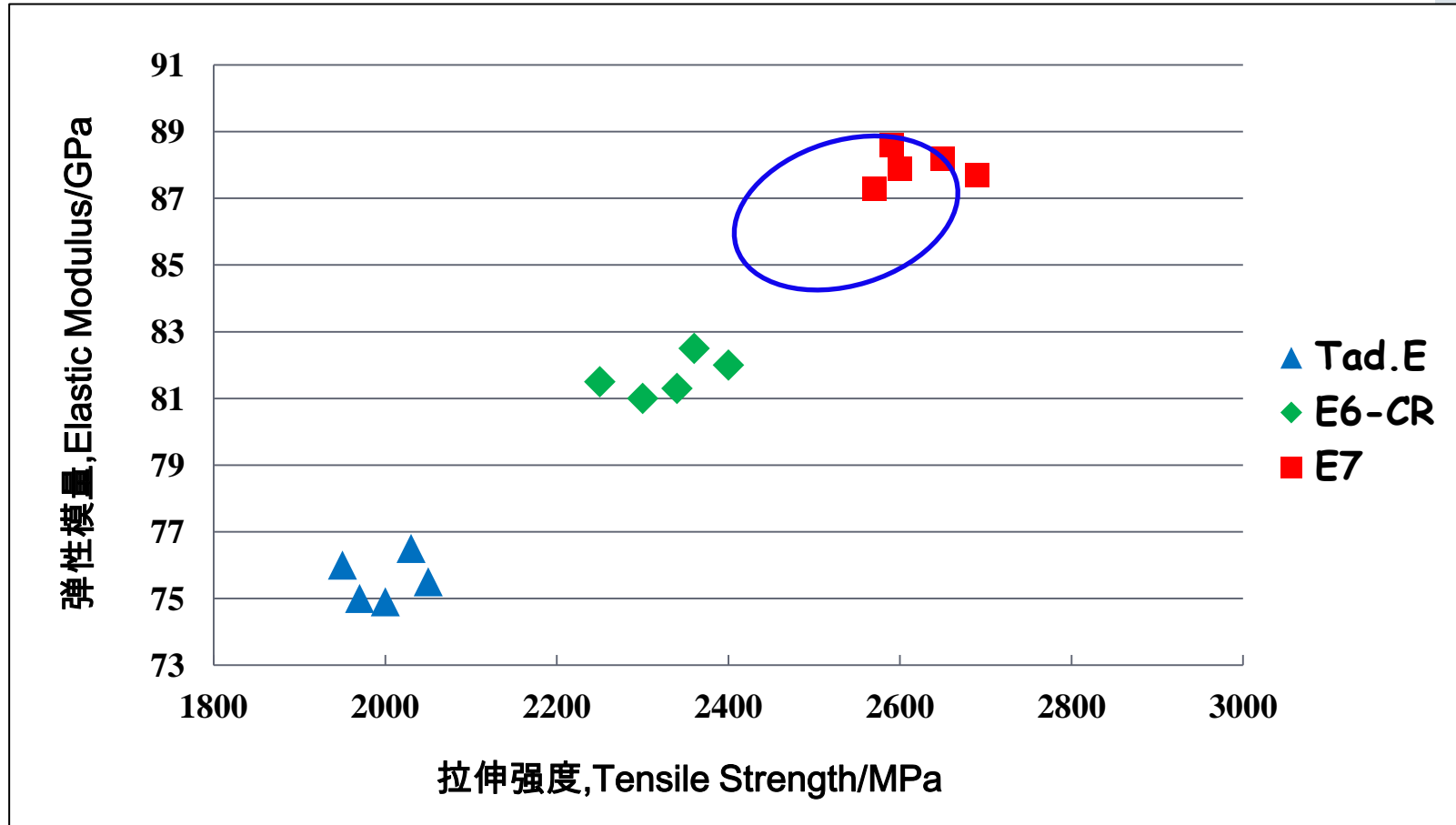
1. The contrast with physical properties of typical fiberglass:

Items	Method	Unit	E7	Tad.E	E6-CR
Density	ASTM1505	g/cm ³	2.63	2.60	2.65
Refractive Index	Immersion	/	1.562	1.566	1.566
Expansion Coefficient	ASTM696	10 ⁻⁶ K ⁻¹	5.51	5.96	5.98
Permittivity	ASTMD150	/	7.0	6.7	7.0
Transition Temperature	ASTMC338	°C	920	842	902



E7 Fiberglass

2. Mechanical properties of E7 fiberglass



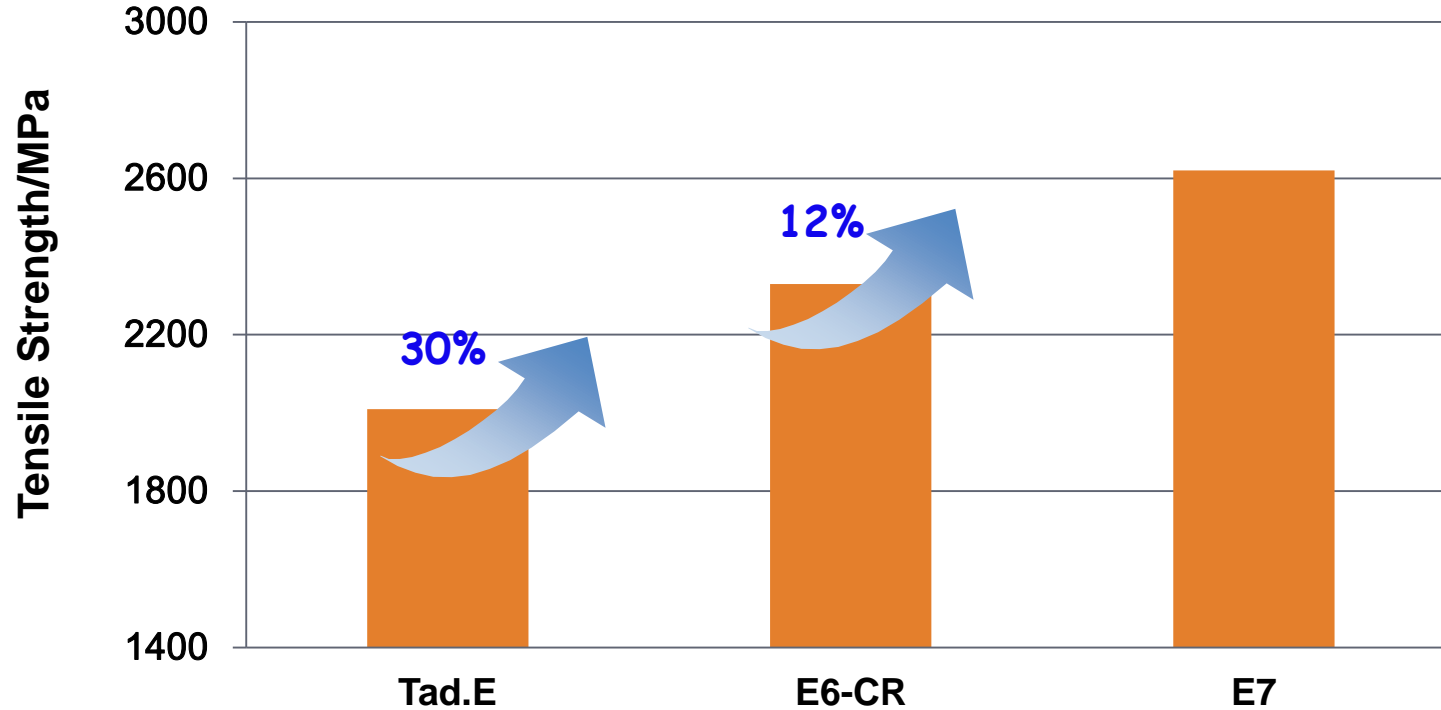
Note: the mechanical properties of impregnated yarn are tested by ASTM2343 standard.



E7 Fiberglass

2. Mechanical properties of E7 fiberglass

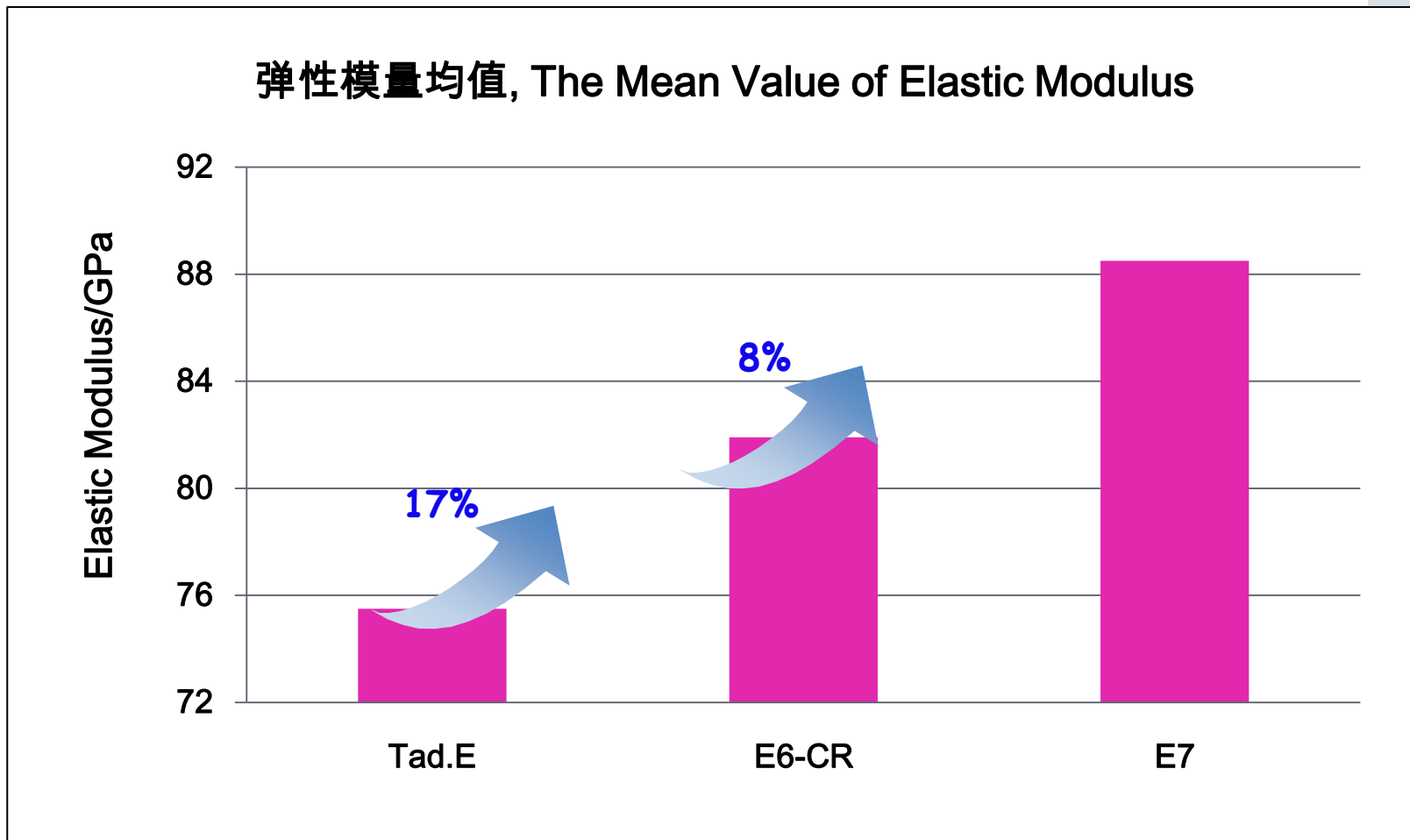
拉伸强度均值, The Mean Value of Tensile Strength





E7 Fiberglass

2. Mechanical properties of E7 fiberglass





E7 Fiberglass

The essential reason of excellent performance:
glass composition

Composition	E7	Tad.E	E6-CR
SiO ₂	59-62	52-55	59-61
Al₂O₃	15-17	12-14	13-15
CaO	14-16	22-25	22-25
MgO	8-10	<0.5	0.5-1
B₂O₃	0	5-7	0
F₂	trace	0.5-1	trace
TiO ₂	<1.5	<0.6	<0.6
Li₂O	<0.6	0	<0.3
Na ₂ O+K ₂ O	<1	<1	<0.8



E7 Fiberglass

Outstanding characteristics summary of E7 fiberglass.

2

High-modulus, high-strength and high-temperature resistance.

1

Accord with EU REACH rule, belong to boron-free fiberglass.

3

Excellent high-temperature resistance.

4

Realized large-scale production, belong to cost-effective product.



E7 Fiberglass

Typical Application Fields



Large wind blade



Mobile muffler



Aviation and police products



High-pressure vessels





Contact information



Product R&D Center

Heinz Zhang

E-mail: heinz.zhang@jushi.com