

专注于高性能玻璃纤维，提供优质解决方案  
Focus on High Performance Fiberglass and Provide Superior Solutions

# 中国巨石增强热塑性复合材料用玻璃纤维介绍

*-Introduction of China Jushi Fiberglass for Thermoplastics*

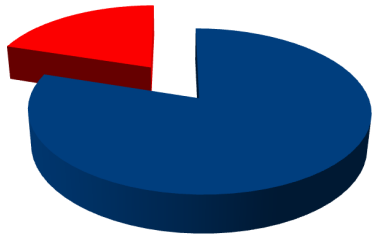
产品研发中心 *R&D Center*  
费振宇 *Karl*



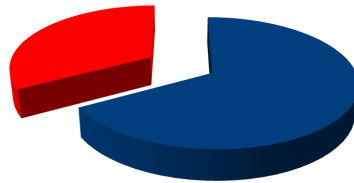
2018年9月21日



- **The world's largest fiberglass manufacturer, annual capacity over 1,600,000 tons in 2018.**
- **Total assets of 3.5 billion US dollar, 9,000 employees.**
- **Six production bases (Tongxiang, Jiujiang, Chengdu, Egypt) , USA base will start in 2018. India base is in preparation.**



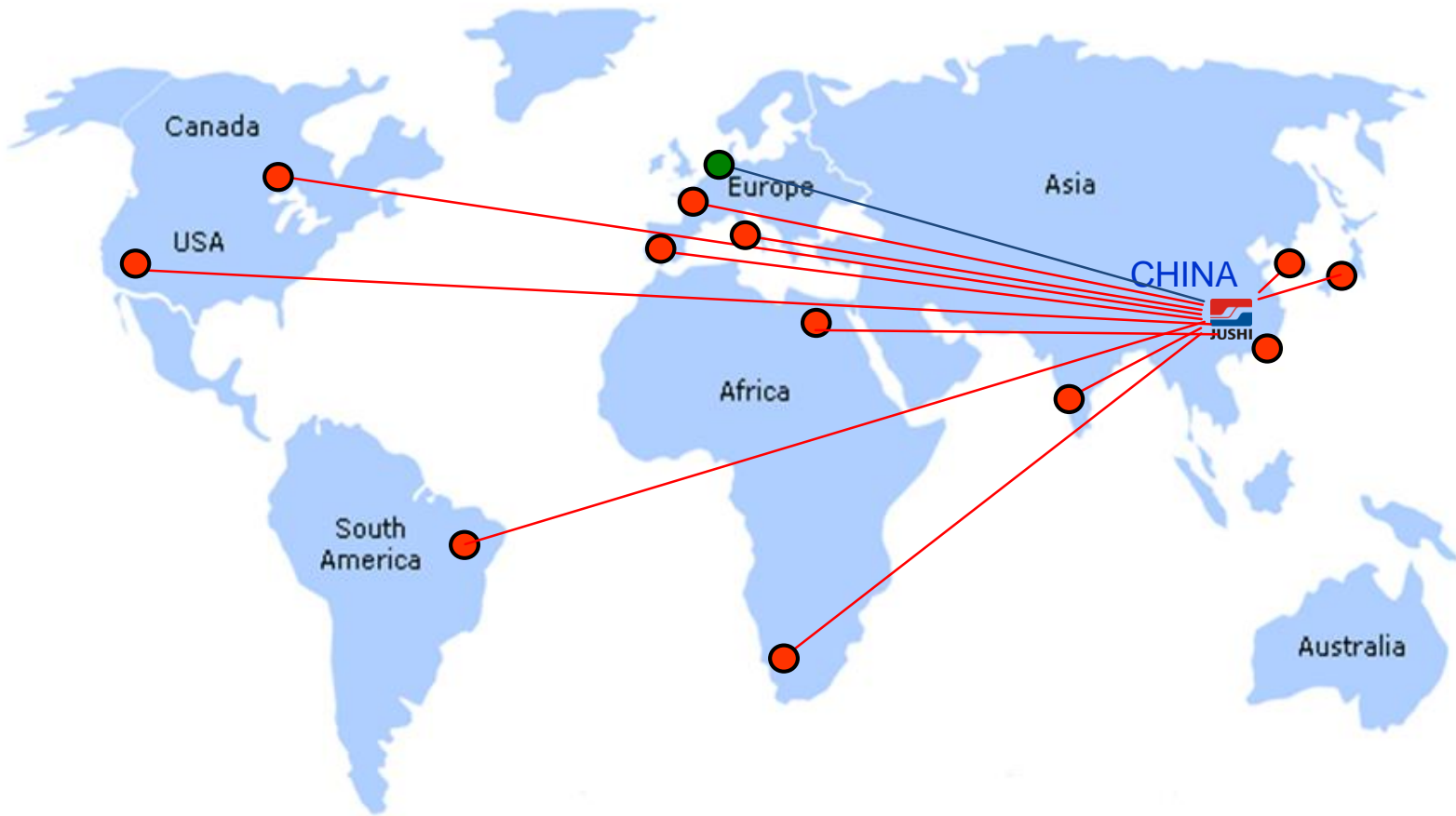
**Global 1/5**



**Domestic 1/3**



## Marketing network



Headquarters



Overseas subsidiary



Exclusive distributor



## 热塑性复合材料在汽车领域的应用

## Application of thermoplastic composites in auto

节能  
Energy-saving

汽车轻量化  
Automobile Lightweight



环保  
Green

重量减少100 kg  
100 kg loss in weight



百公里油耗减少0.5 L  
0.5 L less fuel consumption/100 km  
CO<sub>2</sub>排放减少500 g  
500 g reduction in CO<sub>2</sub> emission

**更轻更强  
的材料!**  
Lighter and  
stronger materials!

热塑性复合材料

Thermoplastic composites

玻纤增强热塑性复合材料

Glass Fiber Reinforced

Thermoplastic Composites

- 质轻，比强度与比模量高  
Low-density, high specific strength and modulus
- 抗冲击性能好  
High impact resistance
- 一体化成型好  
Good integrated molding

- 玻纤：具有一定长径比的高强、高模增强材料  
Fiberglass: high length-diameter ratio, high strength and modulus
- 轻质、高强的复合材料  
Light weight and high performance composites



## 热塑性复合材料在汽车领域的应用

## Application of thermoplastic composites in auto

后视镜  
Rearview mirror



隔音罩  
Sound-proof shield



仪表盘支架  
Instrument panel carrier



前端支架  
Front end carrier



保险杠  
Bumper



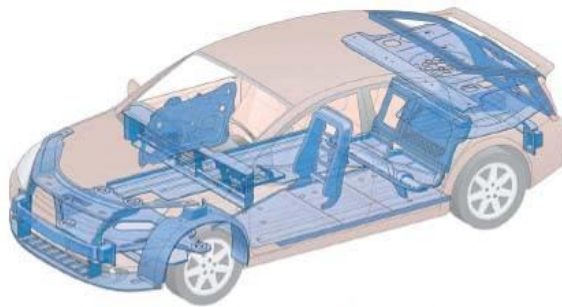
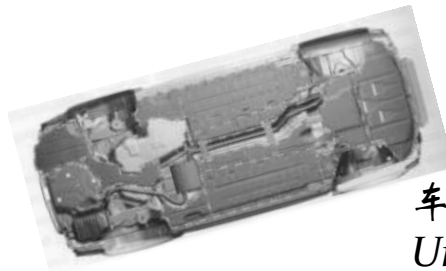
后掀背门  
Tailgate



备胎箱  
Spare wheel shell

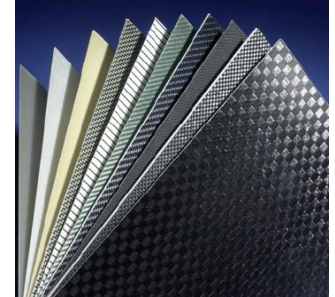


车底护板  
Underbody shield





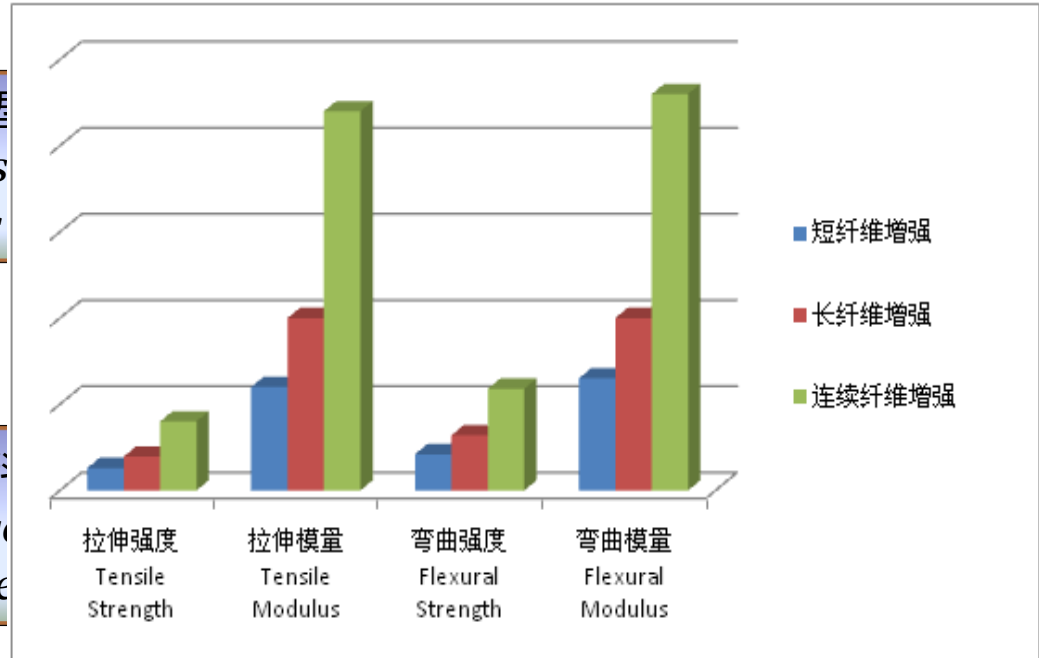
	<b>复合材料中玻纤保留长度(<math>L_r</math>)</b> <b>Remain length of fiberglass in the composites</b>
<b>CFRT</b>	$L_r =$ 制件整长 $L_r =$ the length of the part
<b>LFT</b>	$1\text{mm} < L_r < 25\text{mm}$
<b>SFT</b>	$L_r < 1\text{mm}$



纤维更长，性能更高  
Longer fiber, higher performance

长玻纤增强热塑  
Long fiberglass  
thermoplastic

短玻纤增强热塑性复合材料  
Short fiberglass reinforced  
thermoplastic composite





## 短玻纤增强热塑性复合材料

## *SFT reinforced thermoplastic composites*

### 短切原丝 *Chopped Strands*



#### SFT工艺技术优势：

#### *Advantages of SFT technology:*

✓ 工艺技术成熟，玻纤分散均匀；

*Mature technology, well dispersion of GF;*

✓ 玻纤含量可变范围广(3-60%)；

*Wide range of GF content (3-60%);*

✓ 成型工艺简单、周期短，适于大批量生产；

*Simple molding process, short processing cycle, mass production;*

✓ 兼顾高的生产效率和优良的制品性能。

*Taking account of both the high productivity and good performance.*

SFT占玻纤增强热塑性复合材料的90%以上

*>90% GF reinforced TP composite are SFT*



## 巨石热塑用短切纱产品

## *Chopped strand products for thermoplastics of Jushi*

TP Compatibility	Product code	Remarks
PA	560A	Standard product for PA6, PA66
	568H	Suitable for PA6, PA66, PA46, HTN and PPA, excellent glycol resistance, super high temperature resistance and good fatigue properties
PBT/PET/ ABS/AS/PS	534A	Standard product
	534C	Good color
PP/PE	508A	Standard product
	508C	Excellent detergent resistance, good color
PC	510	Standard product, excellent mechanical properties
	510H	Super high impact properties
<i>m</i> -PPO	540H	Standard product, extremely low out-gassing
PPS/LCP/ PEEK	584	Standard product, excellent hot water resistance





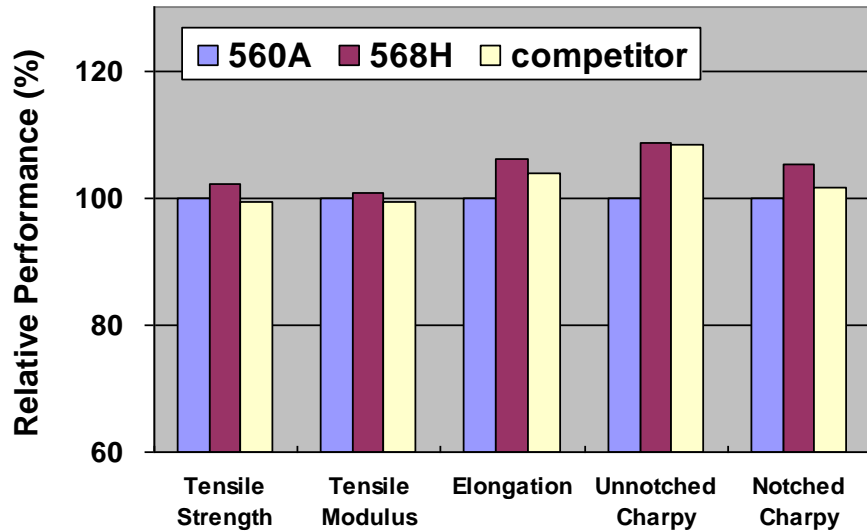
## 568H: 耐水解/醇解型

*568H: Hydrolysis/glycol resistant*

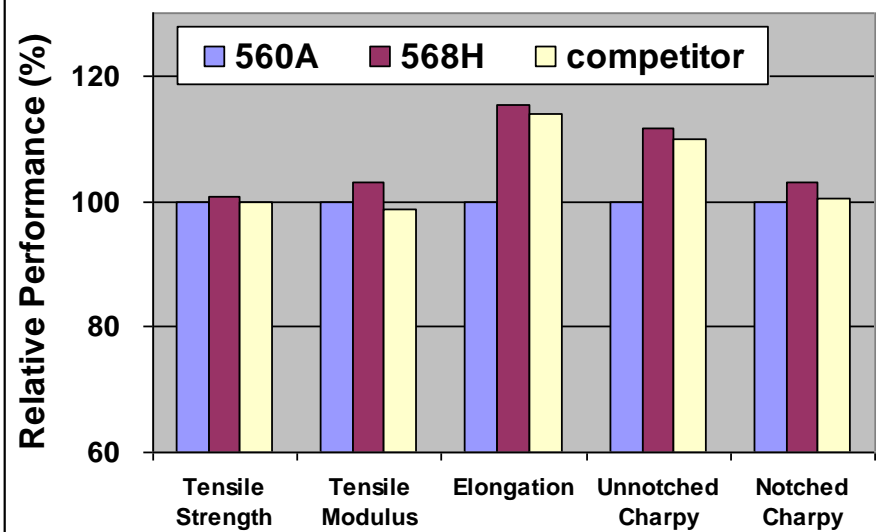
✓ 干态力学性能好

*Good DAM physical properties*

PA6 with 30% Glass



PA66 with 30% Glass





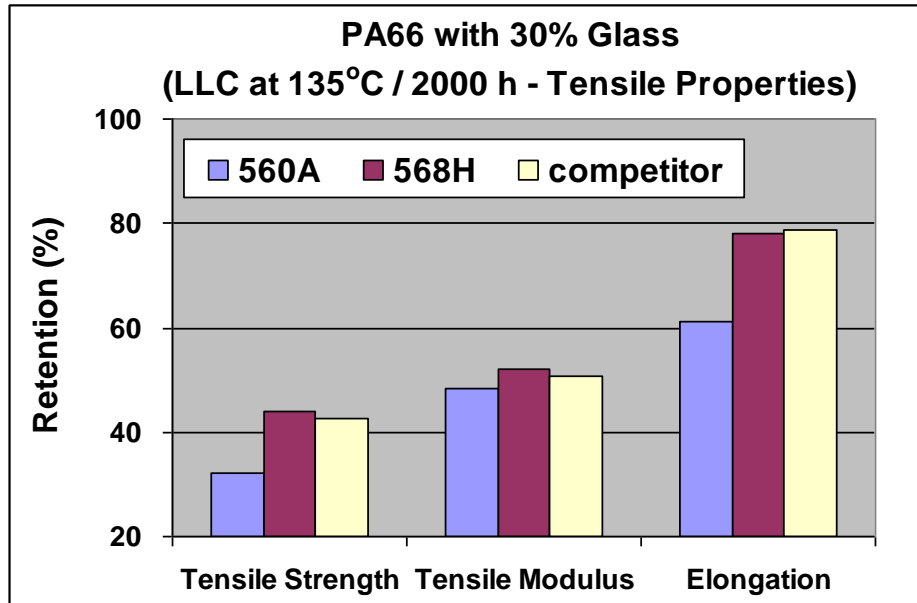
## 568H: 耐水解/醇解型

*568H: Hydrolysis/glycol resistant*

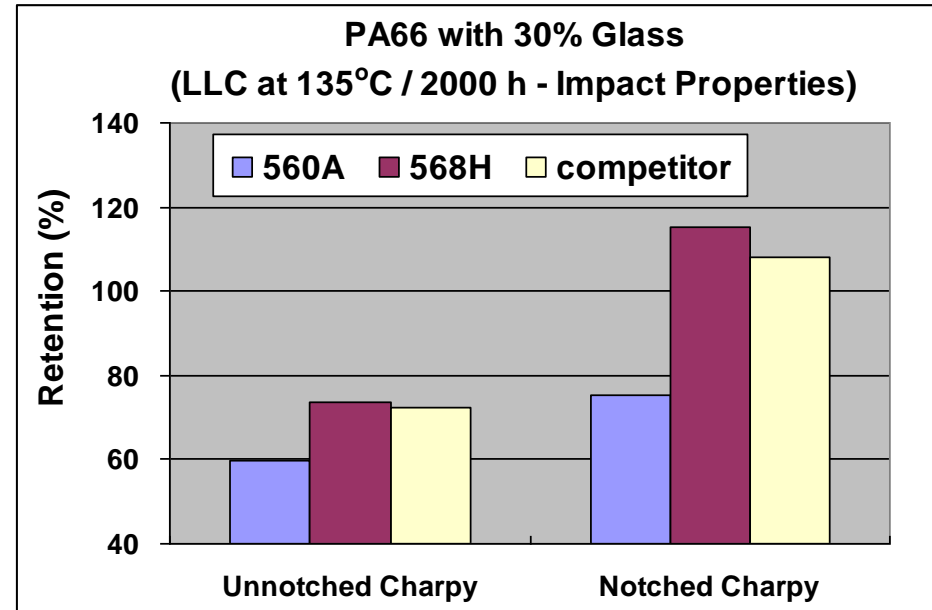
✓ 优异的耐水解/醇解性能

*Excellent hydrolysis/glycol resistance*

### Tensile Properties



### Impact Properties



## 应用

- 耐水解/耐冷冻液

*Applications Hydrolysis/glycol resistance*

- 可用于发动机周边PA部件

*Can be used in PA parts of engine periphery*



冷却系统

*Cooling system*



散热器水室

*Water chamber of radiator* 10

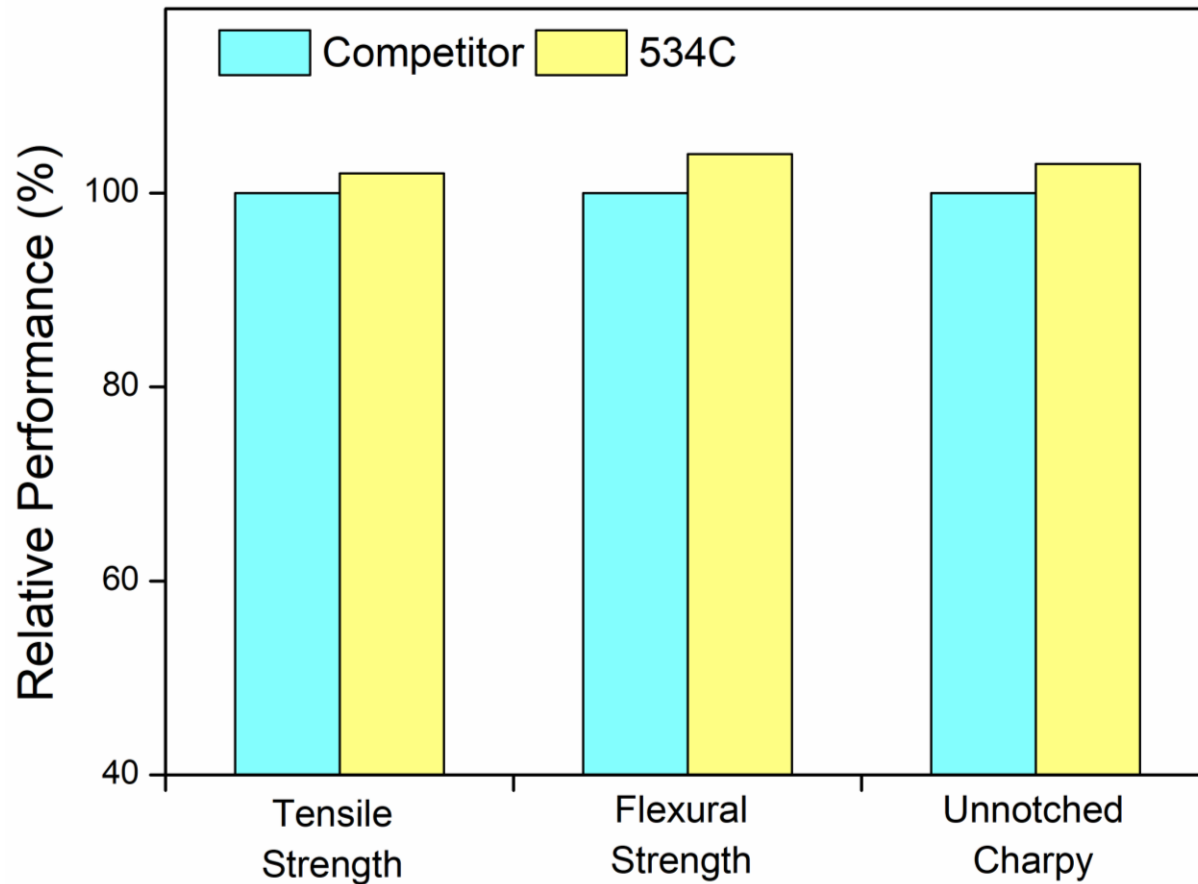


## 534C: 耐水煮/本色料

*534C: Excellent mechanical properties/Natural color*

✓ 力学性能优异

*Excellent mechanical properties*



*PBT: L2100*

*GF content: 30%*



## 534C: 耐水煮/本色料

*534C: Excellent mechanical properties/Natural color*

✓ 制品颜色好

*Natural color*

Sample	Competitor	534C
L (Value of lightness)	83.09	83.74
a (+Red/-green)	0.28	0.09
b (+Yellow/-blue)	8.71	6.44

*Competitor*



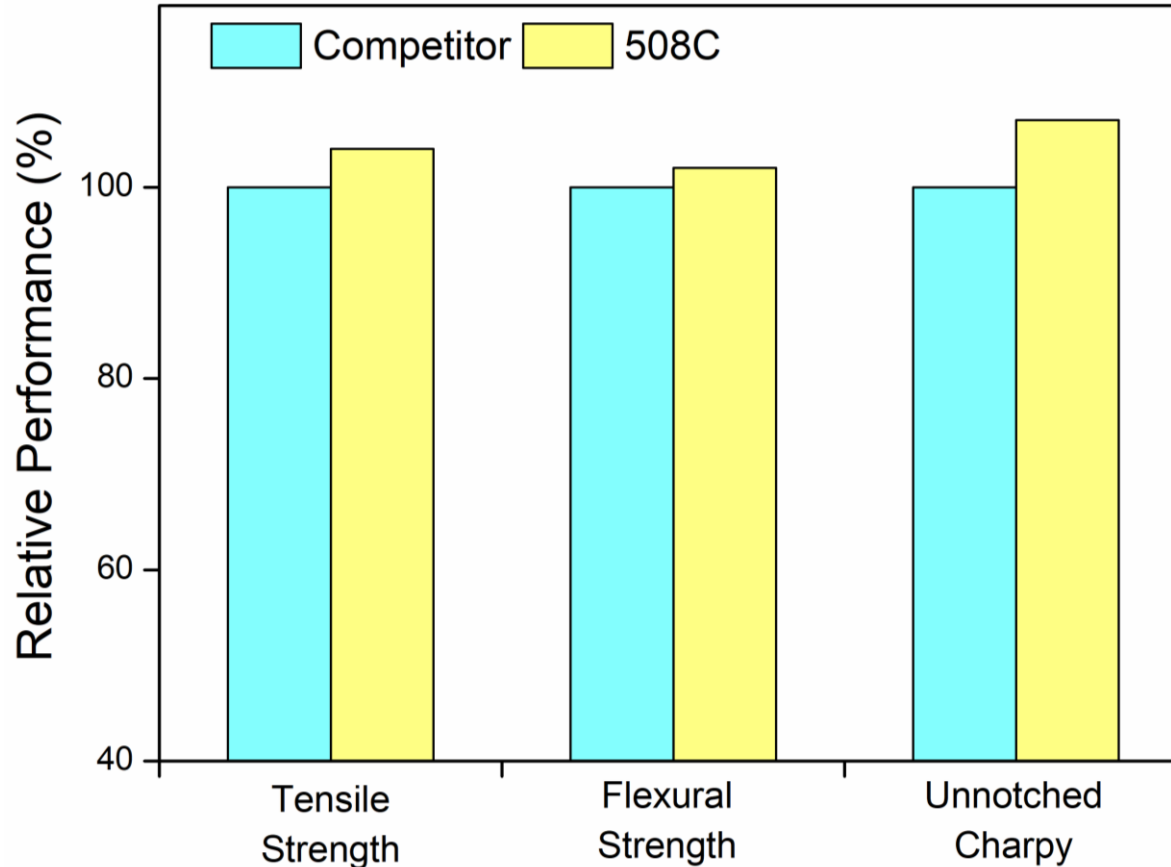
*534C*



**508C: 高性能/耐洗涤剂/本色料** *508C: High performance/Detergent resistant/Natural color*

✓ 干态力学性能好

*Good DAM physical properties*



*PP: F401*

*GF content: 30%*

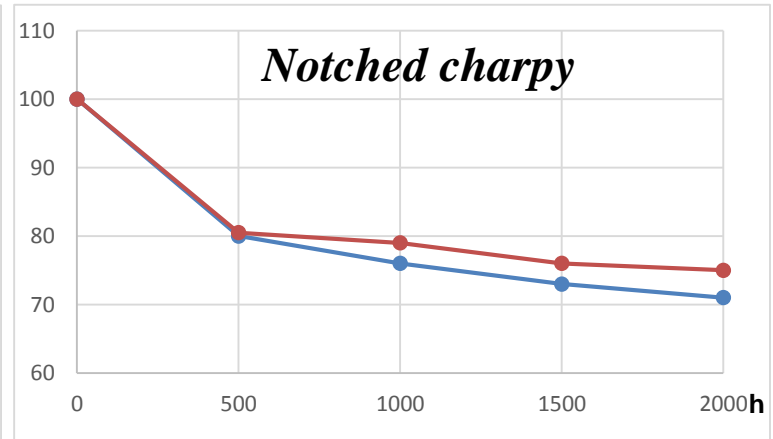
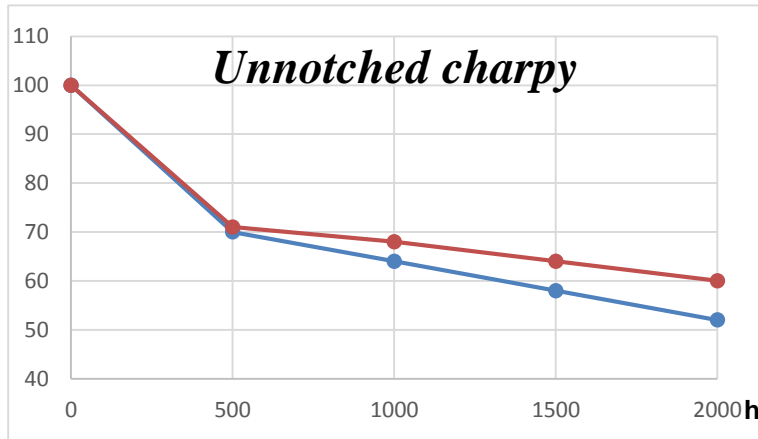
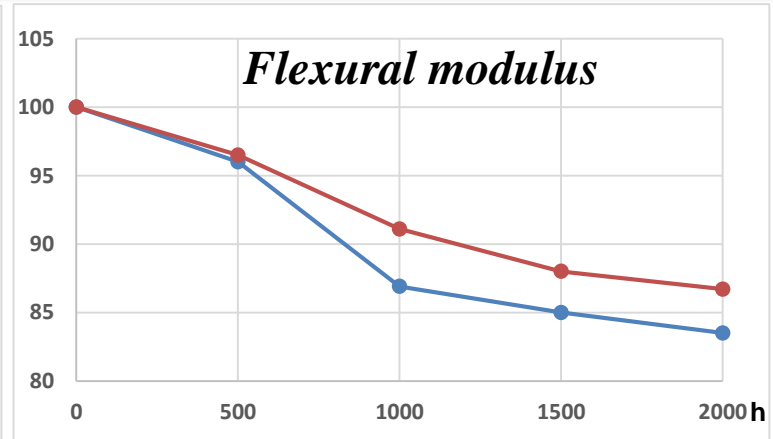
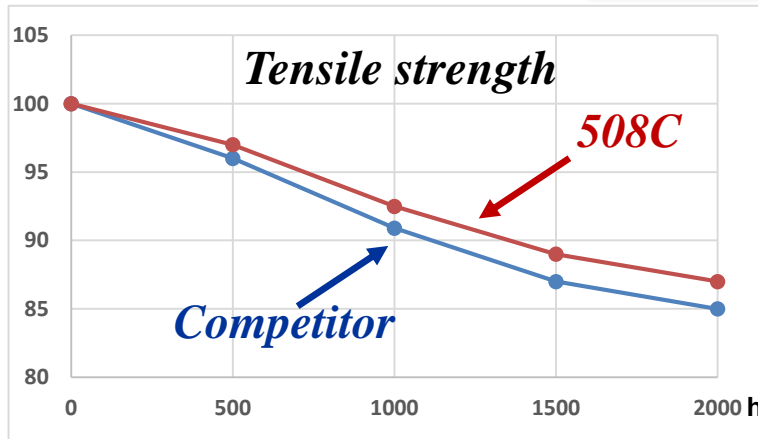


**508C: 高性能/耐洗涤剂/本色料** *508C: High performance/Detergent resistant/Natural color*

✓ 耐洗涤剂性能优异

*Excellent detergent resistance*

*Solution: water with 10g/L detergent and 50ml/L rinse agent  
Temperature: 95 °C  
Retention of properties vs Time*





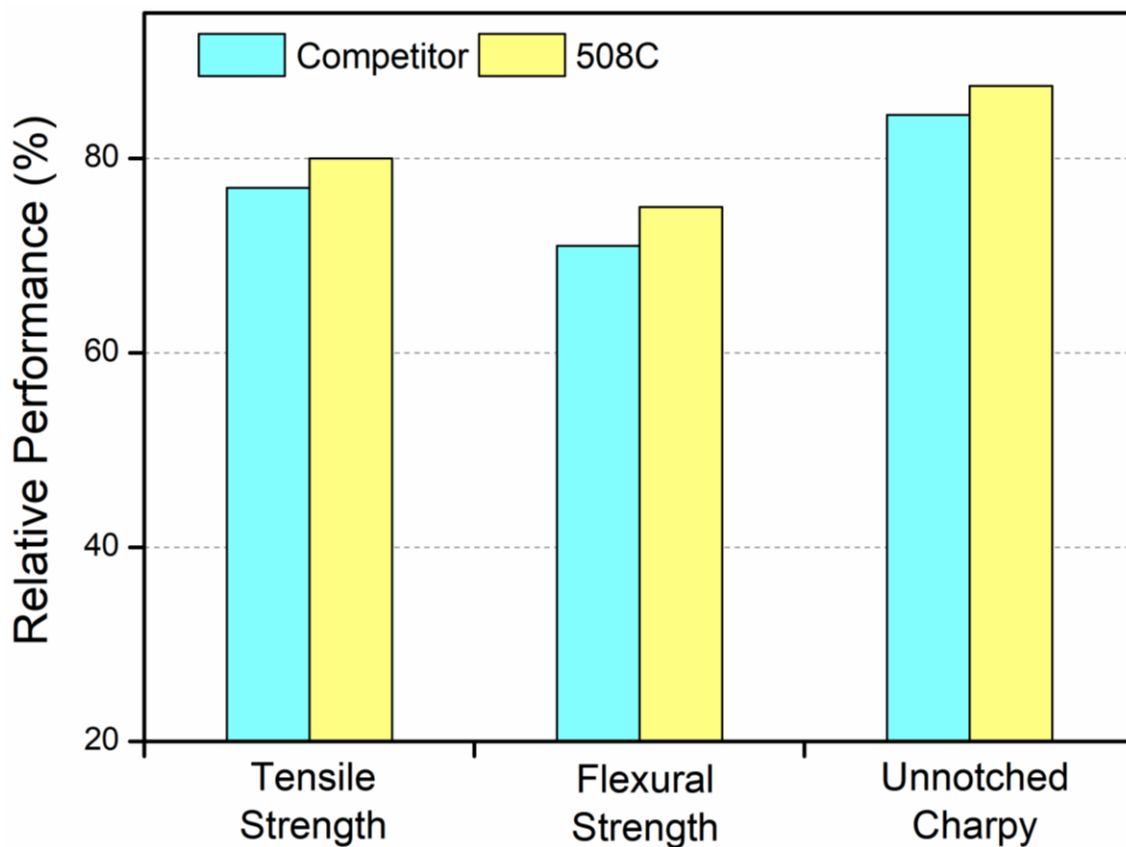
**508C: 高性能/耐洗涤剂/本色料** *508C: High performance/Detergent resistant/Natural color*

✓ 耐热氧化性能好

*Good thermo-oxidative aging resistance*

*Temperature: 150 °C*

*Time: 1500 h*





**508C: 高性能/耐洗涤剂/本色料** *508C: High performance/Detergent resistant/Natural color*

✓ 制品颜色好

*Natural color*

Sample	Competitor	508C
L (Value of lightness)	77.16	77.62
a (+Red/-green)	-3.48	-3.12
b (+Yellow/-blue)	11.17	10.02

*Competitor*



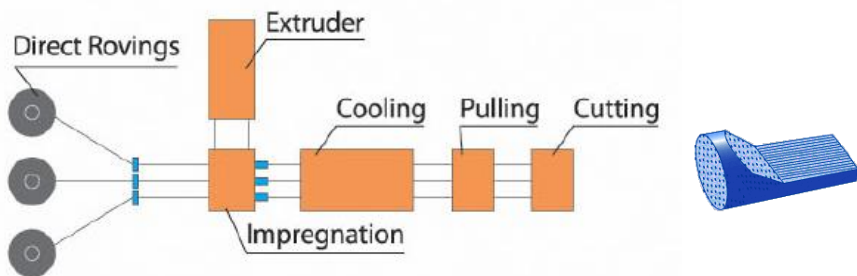
*508C*





## 长玻纤增强热塑性复合材料

## LFT reinforced thermoplastic composites



### 应用 Applications

仪表板支架  
Instrument board carrier



底护板  
Underbody shield



前端支架  
Front end carrier



备胎底壳  
Spare wheel shell



后掀背门  
Tailgate



Product code	TP Compatibility	Remarks
362H	PP/PE	Standard product, fine dispersion, suitable for both LFT-D and LFT-G, FDA authentication.
352B	PA	Excellent processing and mechanical properties.



## 高性能LFT用纱362H

## *High-performance LFT product 362H*

Product code	LOI (%)	Moisture Content (%)	Linear Density (tex)	Filament diameter (μm)
EDR17-2400-362H	0.4 ± 0.15	≤0.10	2400 ± 120	17 ± 1.7

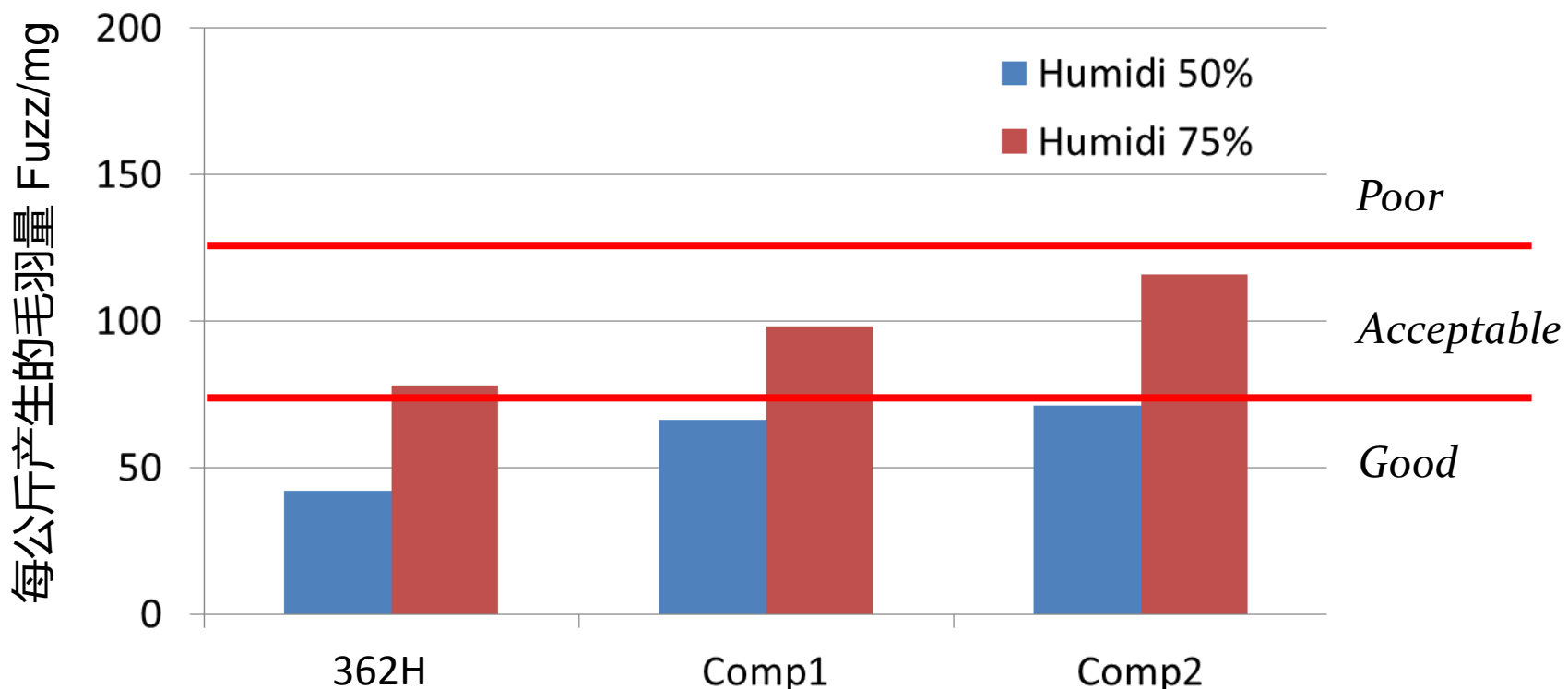
### *Features and Benefits*

- *Outstanding abrasion resistance, low fuzz, suitable for pre-tension system*
- *Good compatibility with PP*
- *Excellent mechanical properties*
- *Good aging resistance*



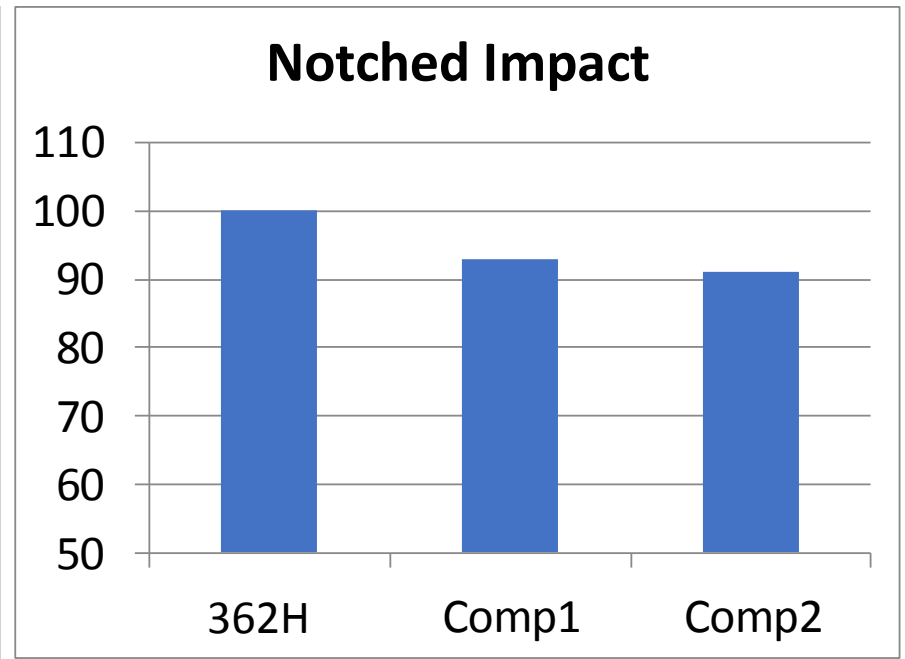
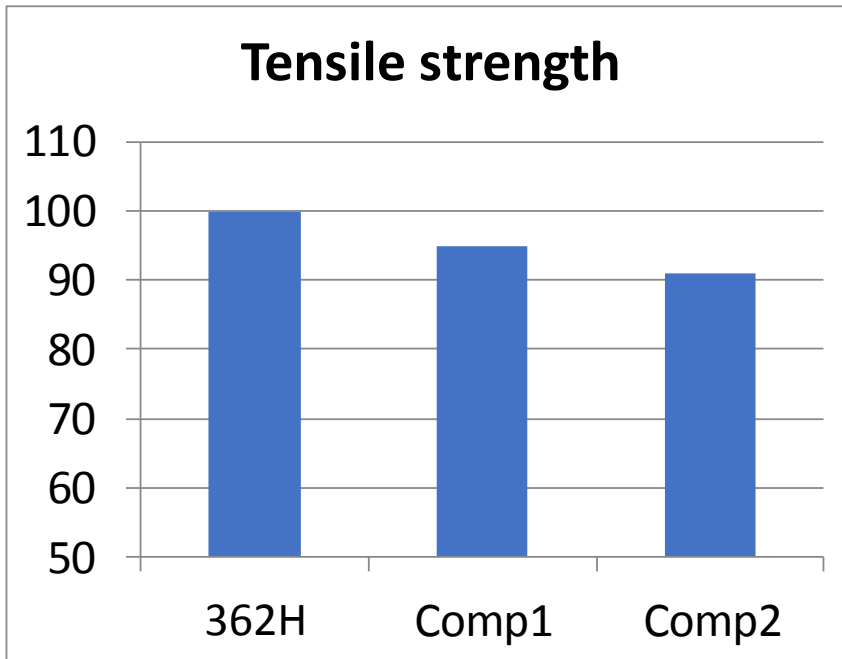
362H产品具备优异的耐磨性  
*Outstanding abrasion resistance*

毛羽量对比, *Fuzz Comparison*



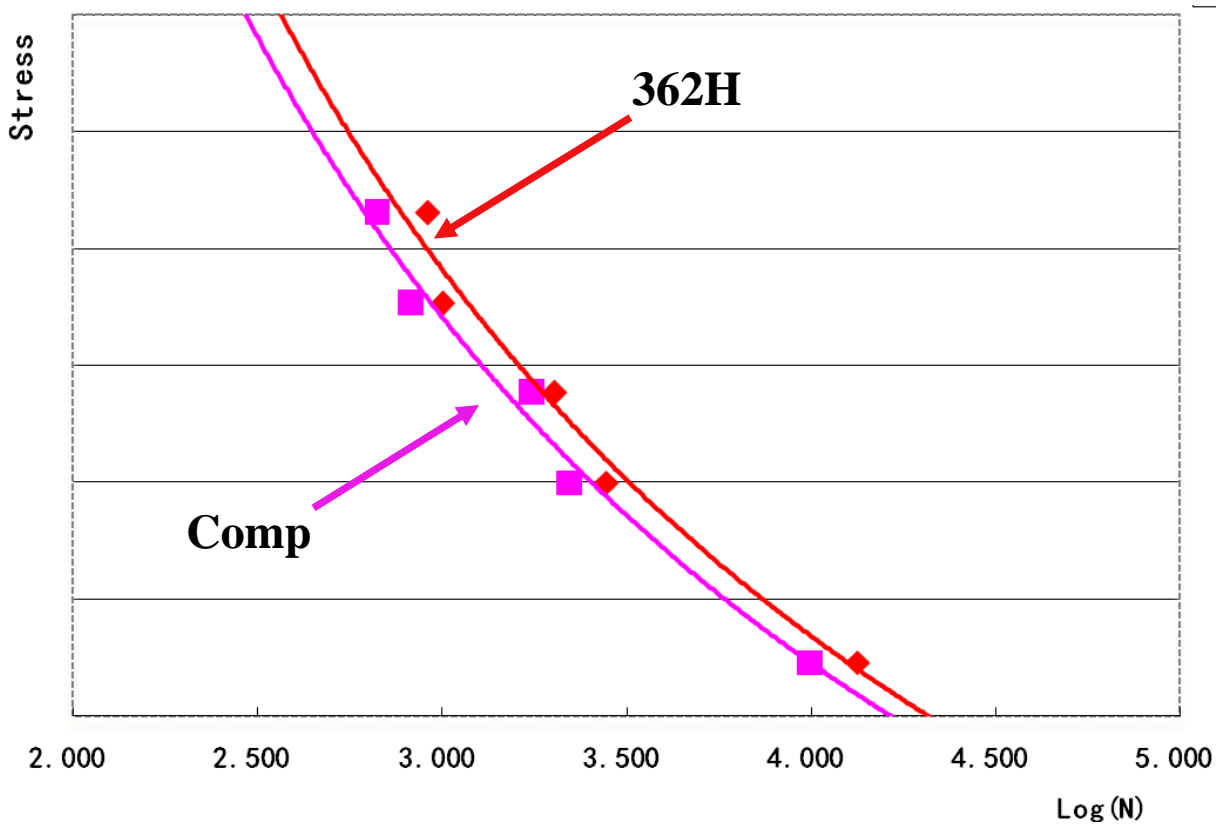


- 制品具有更优异的力学性能 *Excellent mechanical properties*





- 制品具有更优异的疲劳性能 *Excellent fatigue properties*





## 低气味、低VOC排放 *Low smell and VOC*

### 气味测试, *Smell test*

### VOC测试, *VOC test*



测试报告 No. CKGAUTO1700202401 日期: 2017年03月13日 第2页,共4页

测试结果:

测试样品描述:

样品编号	SGS样品ID	描述
SN1	CKG17-002024.001	白色物料

备注:

- (1) 1 mg/kg = 0.0001%
- (2) MDL = 方法检测限
- (3) ND = 未检出 (< MDL)
- (4) "-" = 未规定

气味测试

测试方法: 依据VS-01.00-T-14004-A4-2016车内非金属材料气味试验规范方法进行测试。

样品 001:

试样类型:	1	
取样量:	10g	
<u>评价人员</u>	<u>试验条件1强度</u>	<u>气味描述</u>
人员1	2.0级	-
人员2	2.0级	-
人员3	2.0级	-
人员4	2.5级	轻微无异味
人员5	2.0级	-
试验条件1最终结果	2.0级	
<u>评价人员</u>	<u>试验条件2强度</u>	<u>气味描述</u>
人员1	2.0级	-
人员2	2.0级	-
人员3	2.0级	-
人员4	2.5级	轻微无异味
人员5	2.0级	-
试验条件2最终结果	2.0级	

标准测试: 2级

*Standard: Level 2*

No. BZH80ORZ09411717  
Page: 2 of 3

Test Item	Test Method	Test Instrument	Method Detection Limit (MDL)
Total Carbon Emission	VDA277-1995	HS-GC/FID	5.0 µgC/g
Benzene, Toluene, Ethylbenzene, m-Xylene, p-Xylene, o-Xylene	VDA277-1995	HS-GC/FID	0.1 µg/g

**Test Environment:**  
23°C±2°C, 50%RH±5%RH.

**Test Results:**  
**1. Total Carbon Emission**  
Test specimen mass: 1.000g

Test Result(µgC/g)	1	2	3	Result
	N.D.	N.D.	N.D.	N.D.

Note: (1) µgC/g = microgramme carbon per gram  
(2) N.D. = Less than MDL (or Undetected)

**2. Benzene, Toluene, Ethylbenzene, Xylene**  
Test specimen mass: 1.000g

Test Item	Test Result, µg/g
Benzene	N.D.
Toluene	N.D.
Ethylbenzene	N.D.
m-Xylene	N.D.
p-Xylene	N.D.
o-Xylene	N.D.

Note: (1) µg/g = microgramme per gram  
(2) N.D. = Less than MDL (or Undetected)

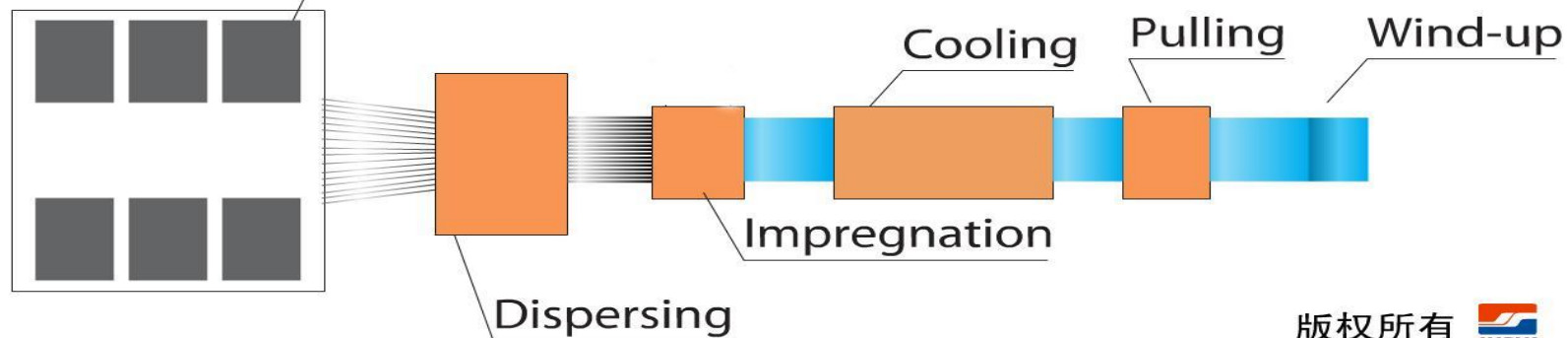
Report in electronic version is only for client's preview and reference.  
For confirmative content, formal test report shall prevail.



## CFRT成型工艺

## CFRT processing technology

Direct Rovings



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模压成型(0度和90度方向叠加)

*Molding process (complex of 0 angle and 90 angle slice)*

缠绕成型

*Taping process*



■ 巨石适合CFRT产品规格 *Identification*

Code	Suitable for process	Linear density (tex)	Resin
<b>362C</b>	<b>CFRT</b>	<b>2400, 1200</b>	<b>PP/PE</b>
<b>352B</b>	<b>CFRT</b>	<b>2400, 1200</b>	<b>PA/PET</b>



产品特点

- 外退使用顺畅 *Outside-unwinding smoothly*
- 纱线易分散，毛羽少 *Easy to disperse and low fuzz under tension*
- 与热塑性树脂相容性优异 *Excellent compatibility with thermoplastic resin*





- 362C产品在PP树脂中具备优异的分散性和浸渍效果

*362C has excellent dispersion and impregnation in PP resin*

**(A) Comp**

**(B) 362C**





■ 362C产品具备优异的力学性能 *Outstanding mechanical properties*



Item	Resin	Glass content (%)	Tensile strength (MPa)	Tensile modulus (GPa)
362C	PP	61.9	812.6	22.7
Comp	PP	62.2	738.7	19.6

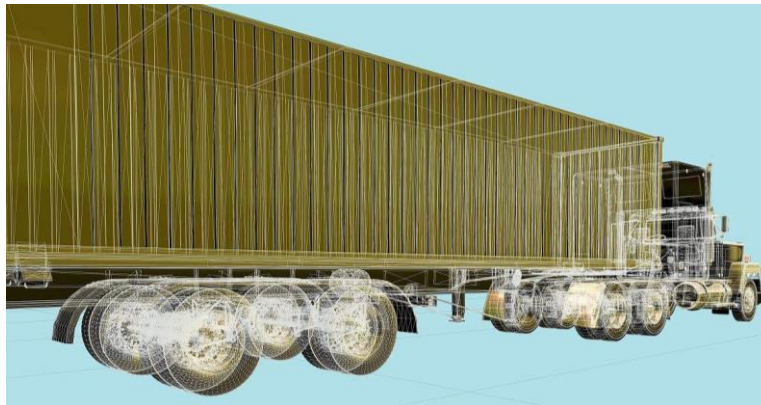
CFRT产品应用  
*Application of CFRT products*

干燥车厢护板  
*Dry freight liner panels*

车厢衬垫  
*Sub pan*

冷冻车厢侧壁  
*Reefer walls*

半透明车厢顶棚  
*Translucent proofs*





## 未来发展趋势

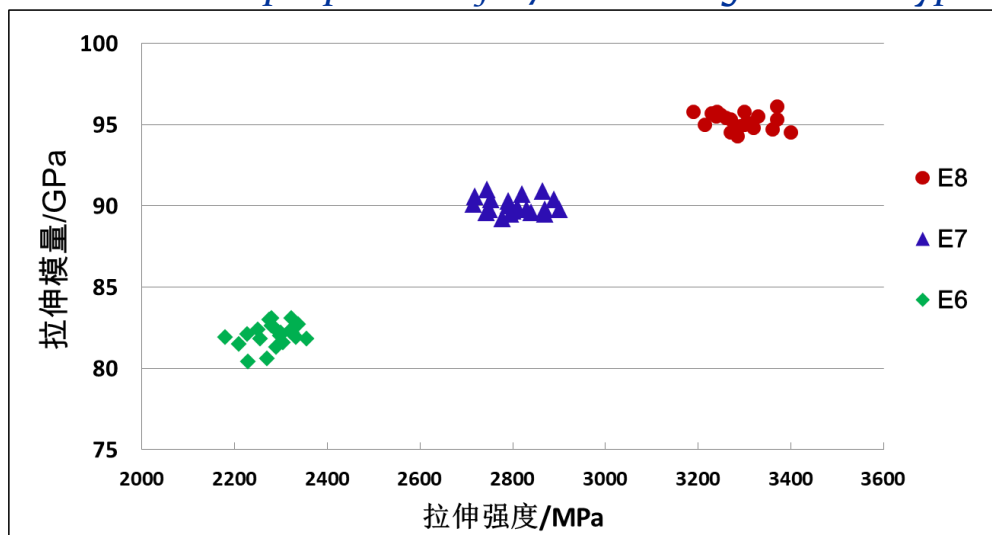
*Future development trend*

更高强度

更高模量

E7, E8与典型E玻璃机械性能对比

*Mechanical properties of E7- and E8- glass and typical E-glass*



备注:采用ASTM D2343标准测试浸渍纱的机械性能。

Note: The mechanical properties of impregnated yarn are tested by ASTM D2343 standard.



E7-568H

E7-568H增强尼龙复合材料优点

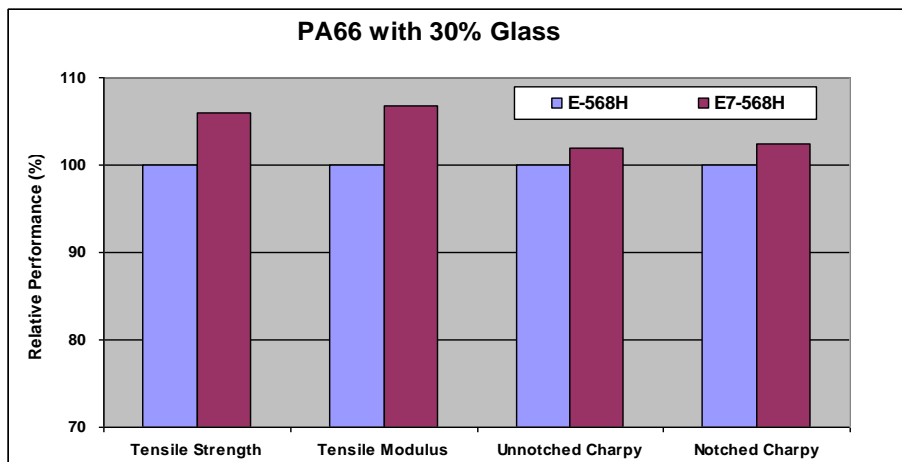
The advantages of PA66/E7-568H Composite

- ◆ 高强度/High strength
- ◆ 高模量/High modulus
- ◆ 优异的耐疲劳性能Excellent Fatigue resistance
- ◆ 优异的耐醇解性能/Excellent glycol resistance
- ◆ 优异的耐高温性能Excellent heat resistance



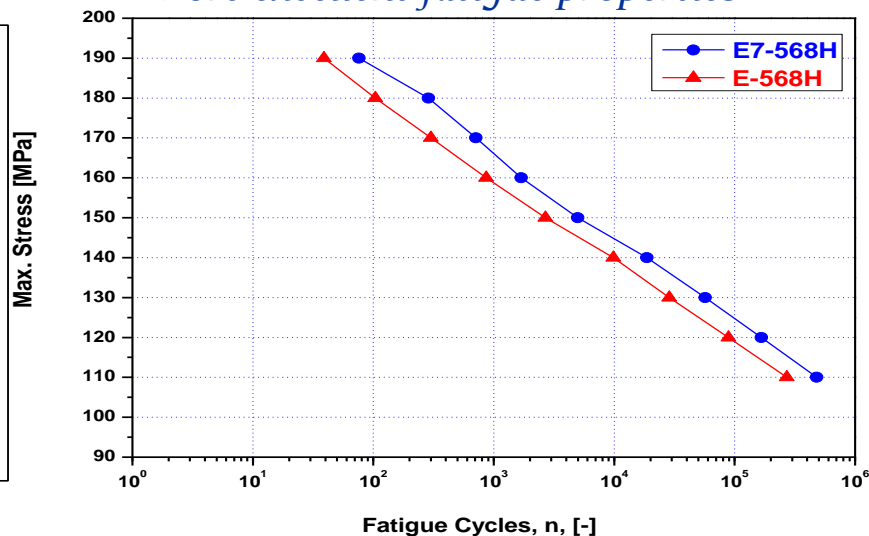
✓ 干态力学性能更好

*Better DAM physical properties*



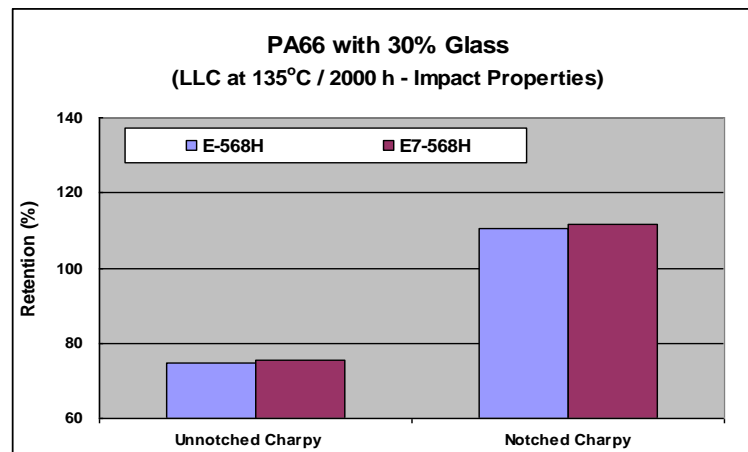
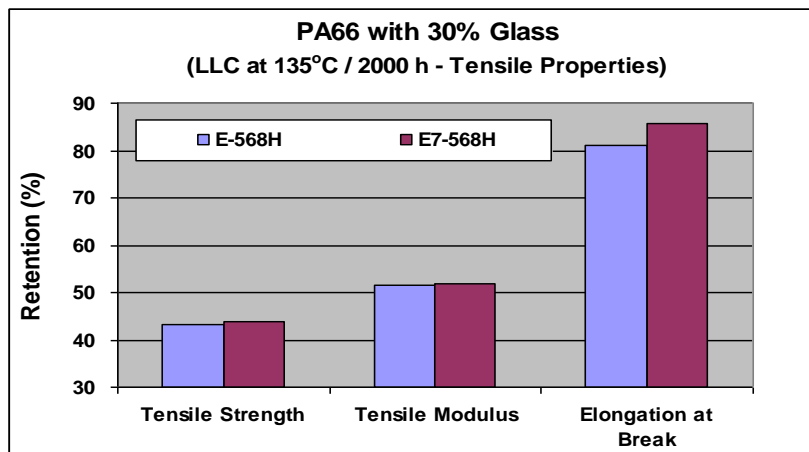
✓ 更优异的耐疲劳性能

*More excellent fatigue properties*



✓ 更优异的耐水解/醇解性能

*More excellent hydrolysis/glycol resistance*





中国巨石玻纤增强热塑性复合材料  
China JUSHI Fiberglass Reinforced Thermoplastic Composites



专注于高性能玻璃纤维，提供优质解决方案  
Focus on High Performance Fiberglass and Provide Superior Solutions

**谢谢大家**  
**Thanks**

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