

Ashland Composite Polymers

AROPOL®



AROPOL® M 105

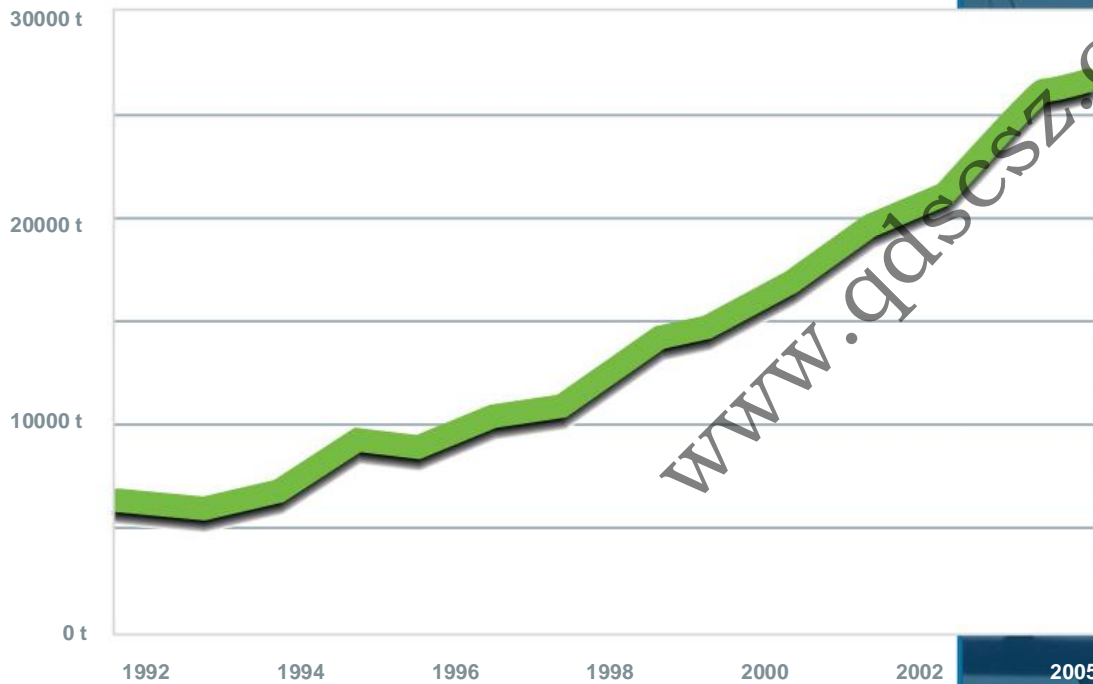
低挥发(LSE)树脂

Low Styrene Emission (LSE) Resins

ASHLAND®

AROPOL® M 105 Low Styrene Emission (LSE) Resins

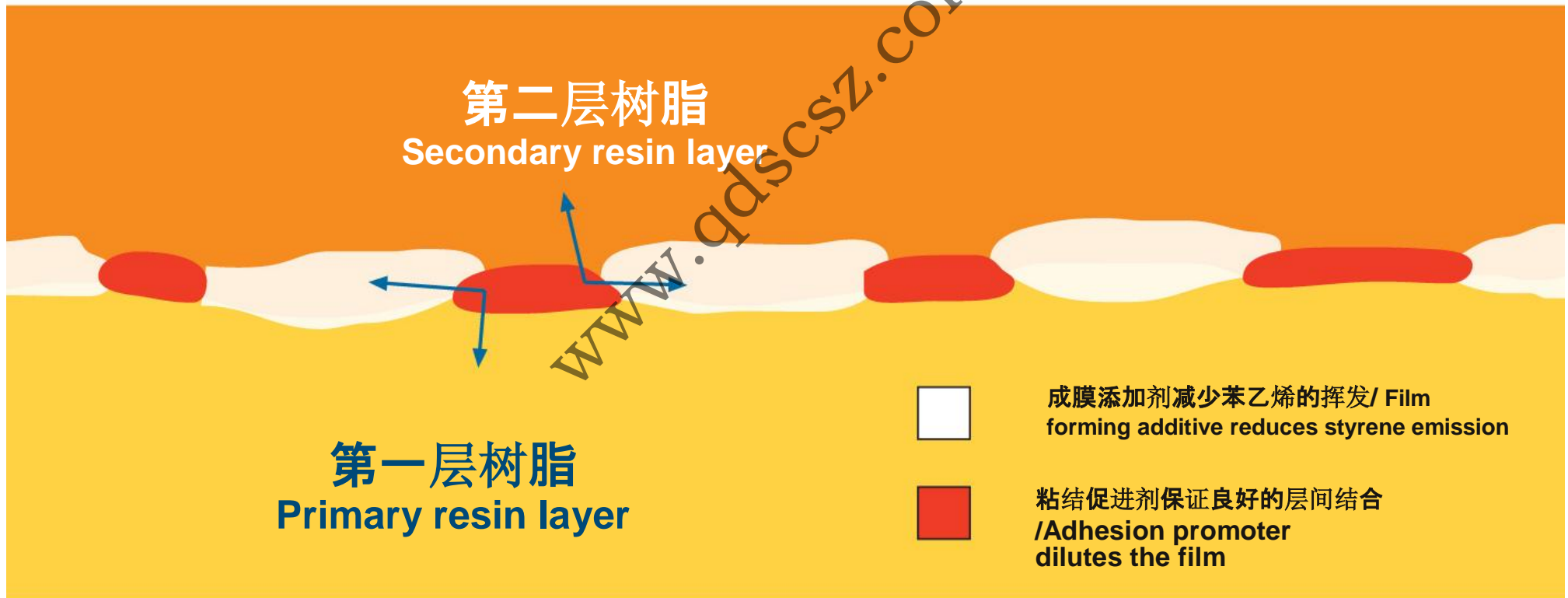
低挥发树脂的销售量/ Over all sales of LSE resins



玻璃钢生产厂越来越信赖亚什兰的低挥发树脂, 现在已有一大部分开模用户在使用低挥发树脂。

Fabricators are more and more relying on Ashland's LSE resins and a big part of open molding is today using these products.

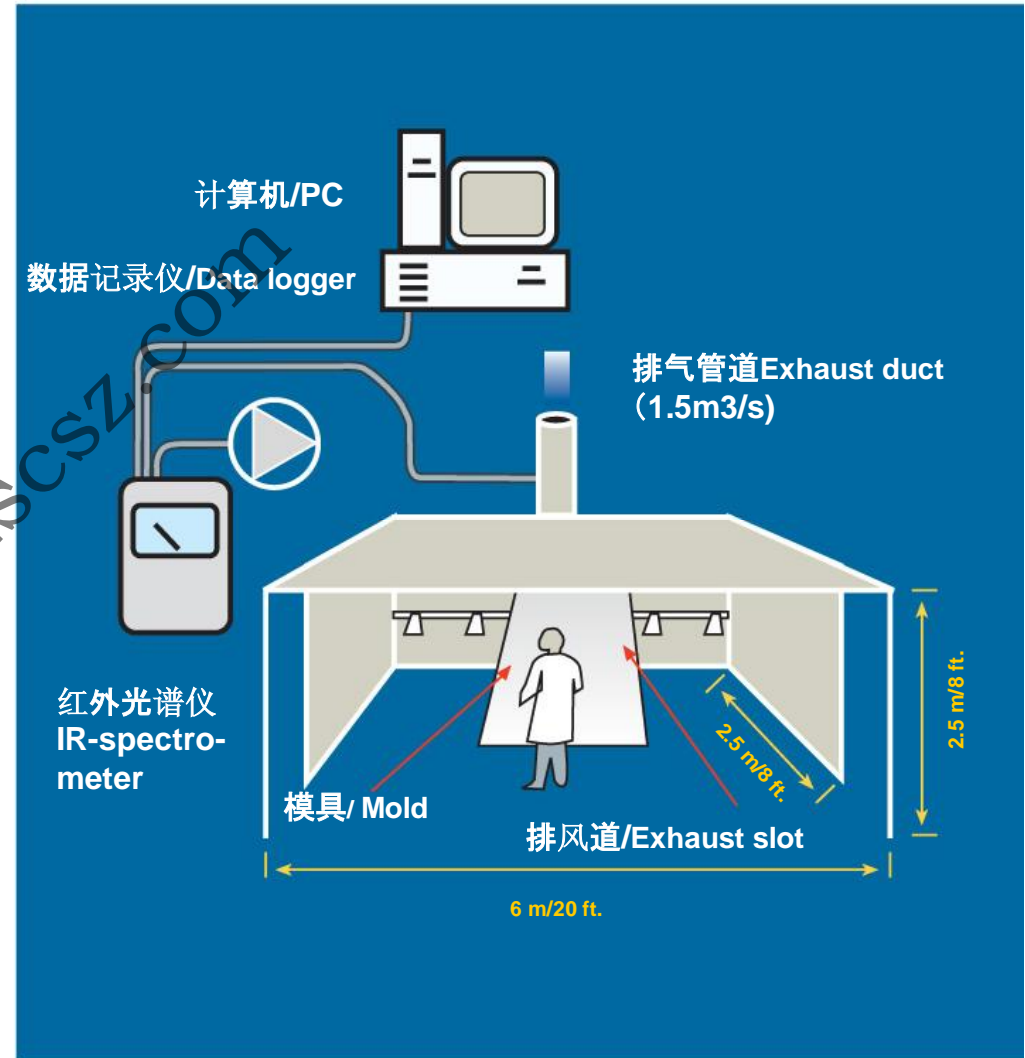
低挥发树脂的机理/ Mechanism of the LSE concept



- 低苯乙烯挥发技术 / Low styrene emission technology
- 高浸润性技术 / High wetting technology
- 控制固化放热技术 / Low peak exotherm technology

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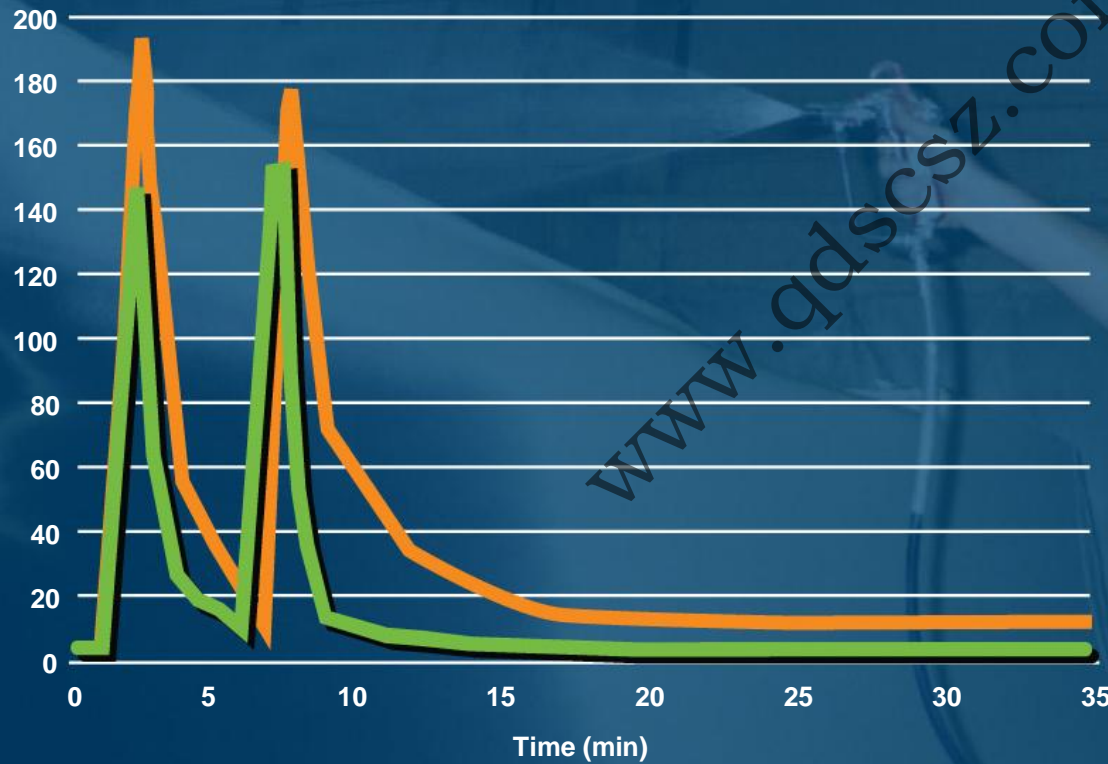
建立专试验间，用红外光谱仪检测苯乙烯挥发量。
Set up of application booth for measuring styrene emission by infra-red spectroscopy



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AROPOL® M 105 Low Styrene Emission (LSE) Resins

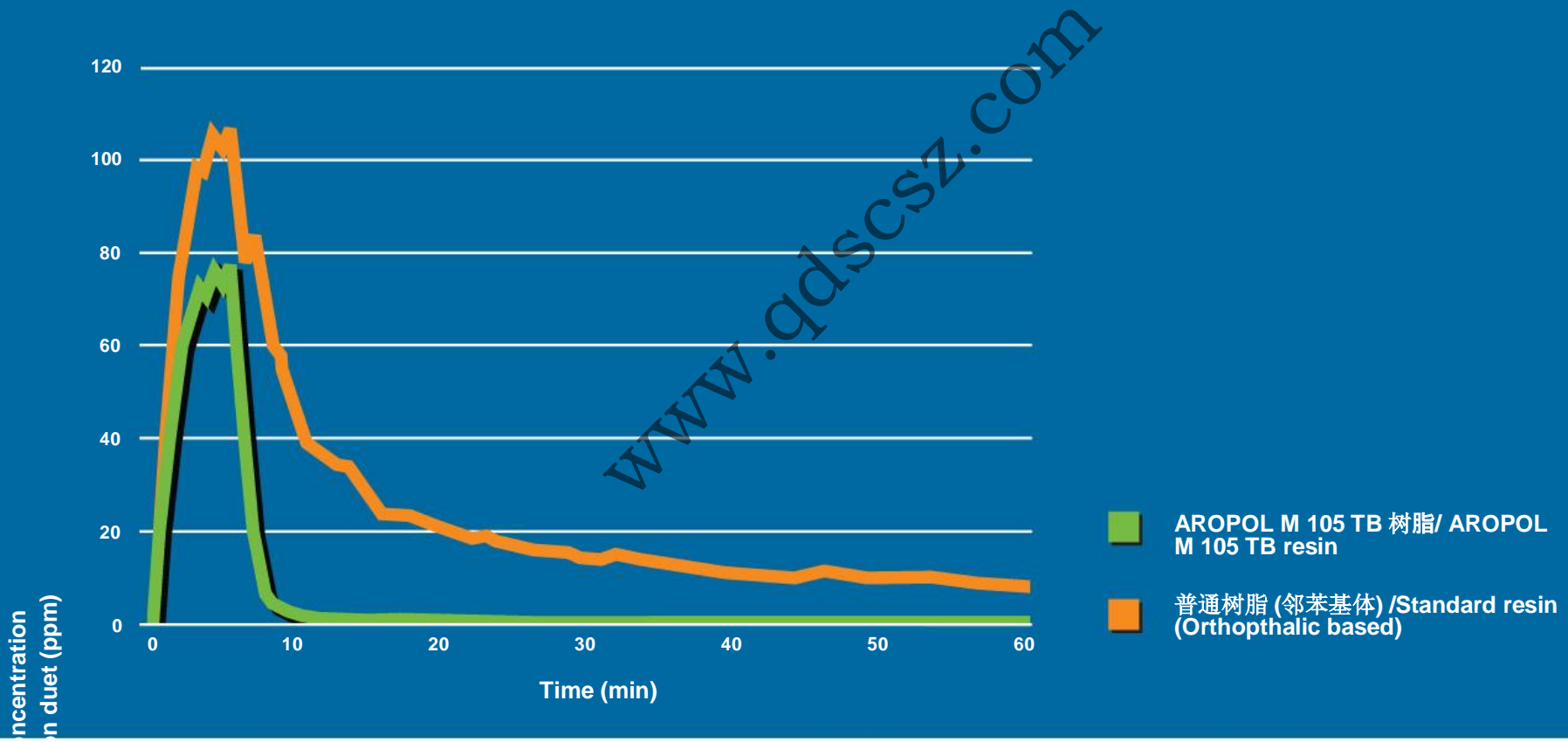
喷射成型工艺苯乙烯挥发量/Spray-up in application booth



AROPOL M 105 TB 树脂积分面积为 70个单位/ AROPOL M 105 TB resin integrated area 70 units
普通树脂 (邻苯基体) 积分面积为100个单位/ Standard resin (Orthophthalic based) integrated area 100 units

AROPOL® M 105 Low Styrene Emission (LSE) Resins

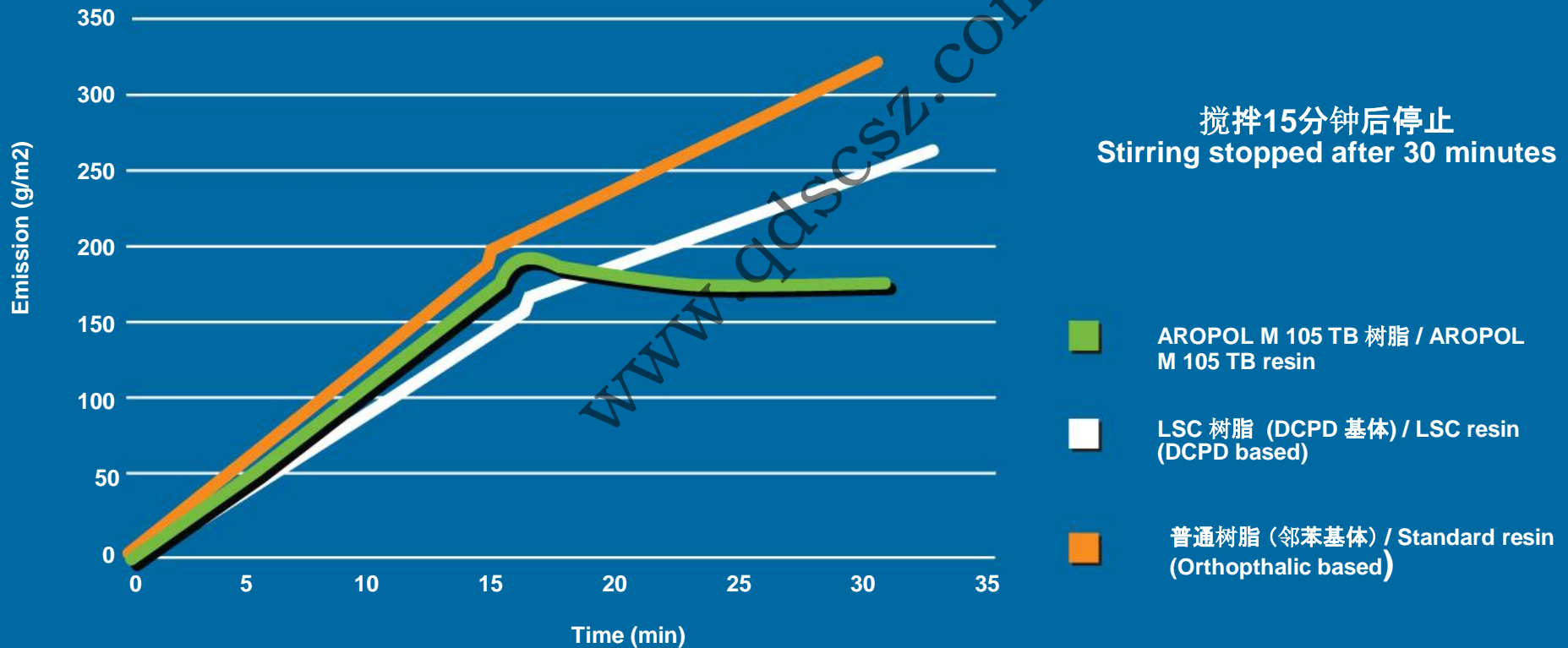
手糊成型工艺苯乙烯挥发量/Hand lay-up in application booth



AROPOL[®] M 105 Low Styrene Emission (LSE) Resins

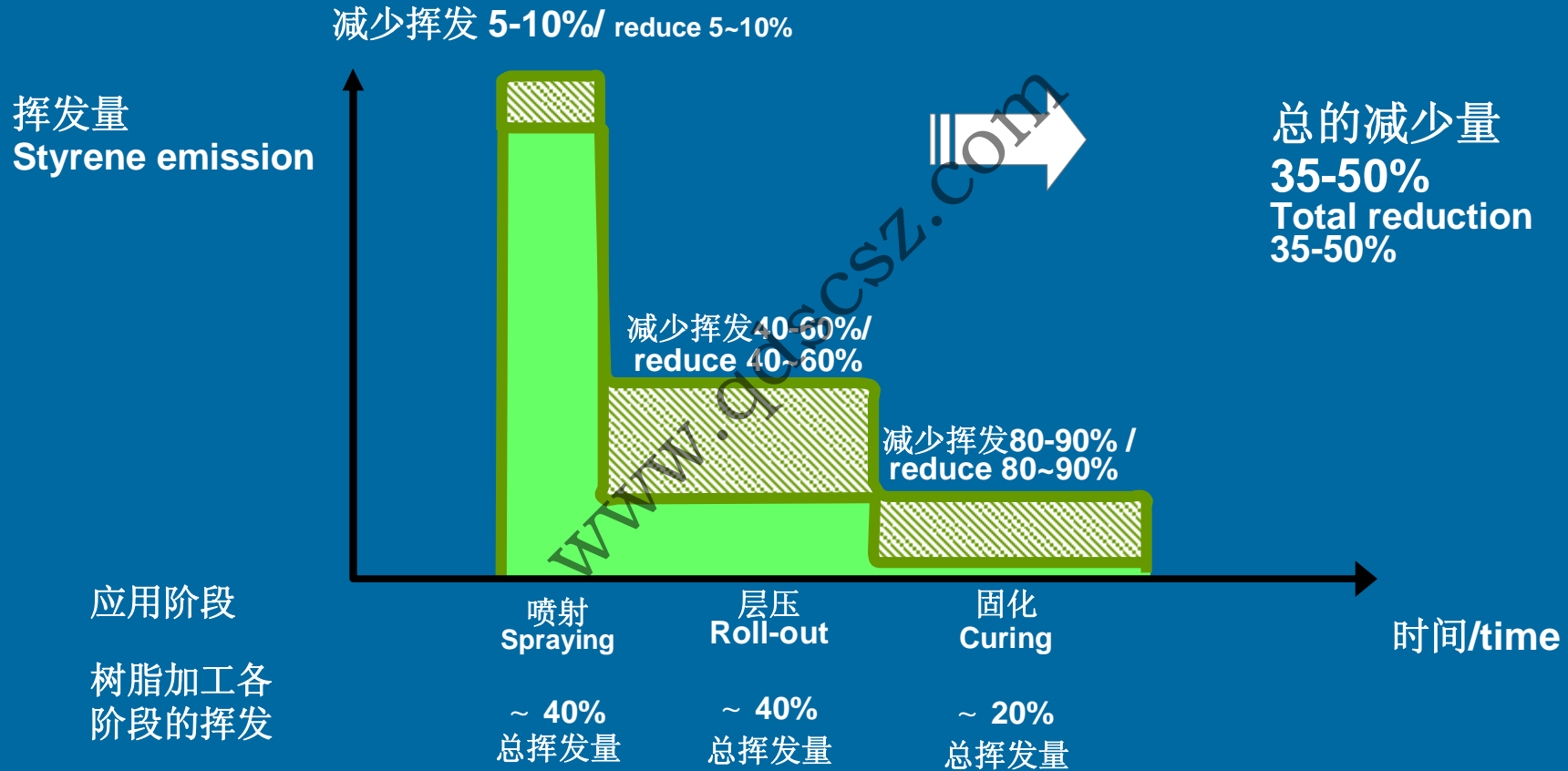
动态-静态苯乙烯挥发试验

Styrene emission measured by dynamic-static emission test method



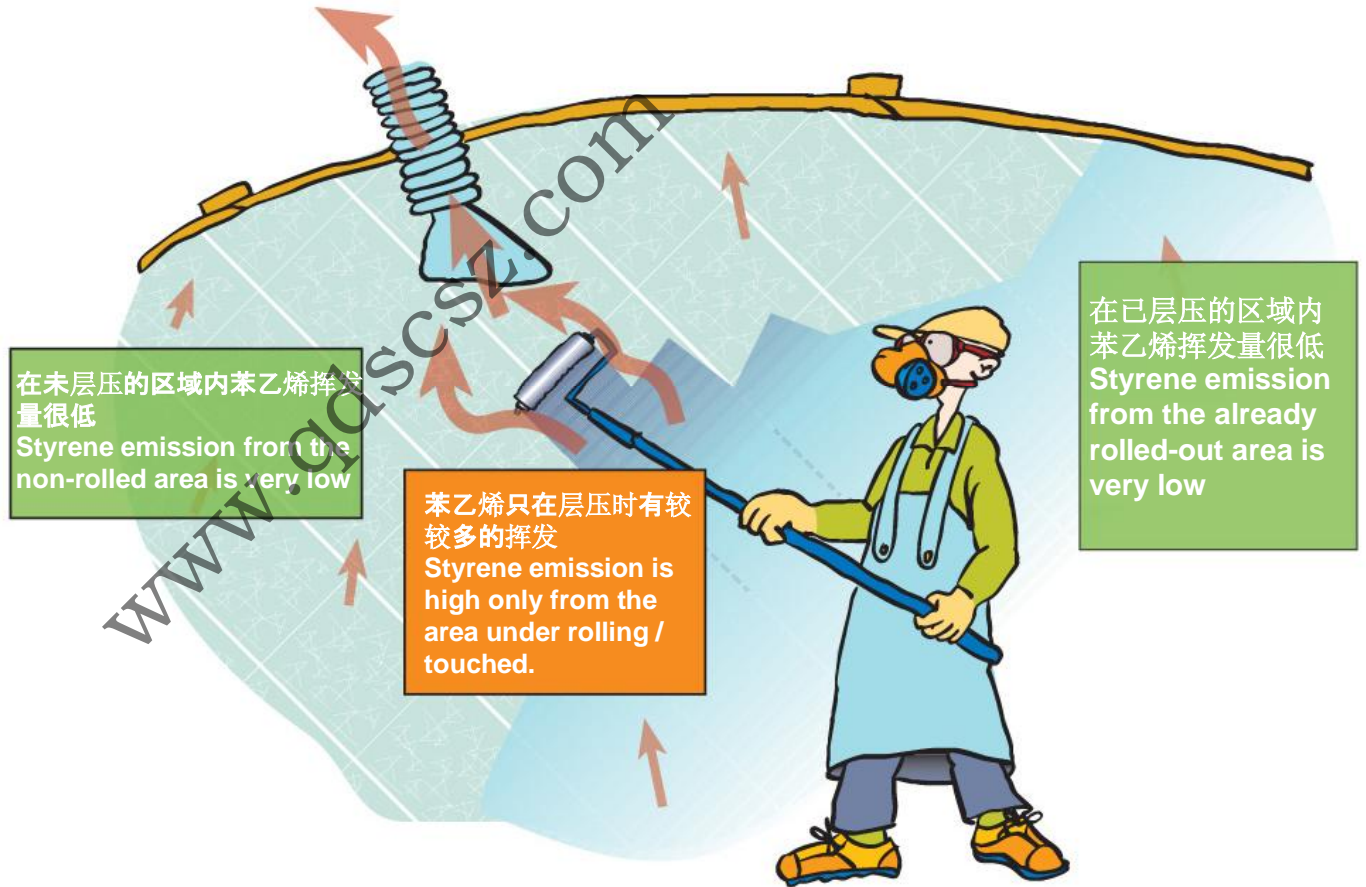
低挥发树脂是如何减少苯乙烯挥发的？

Styrene emission when applying LSE resin compared to standard resin



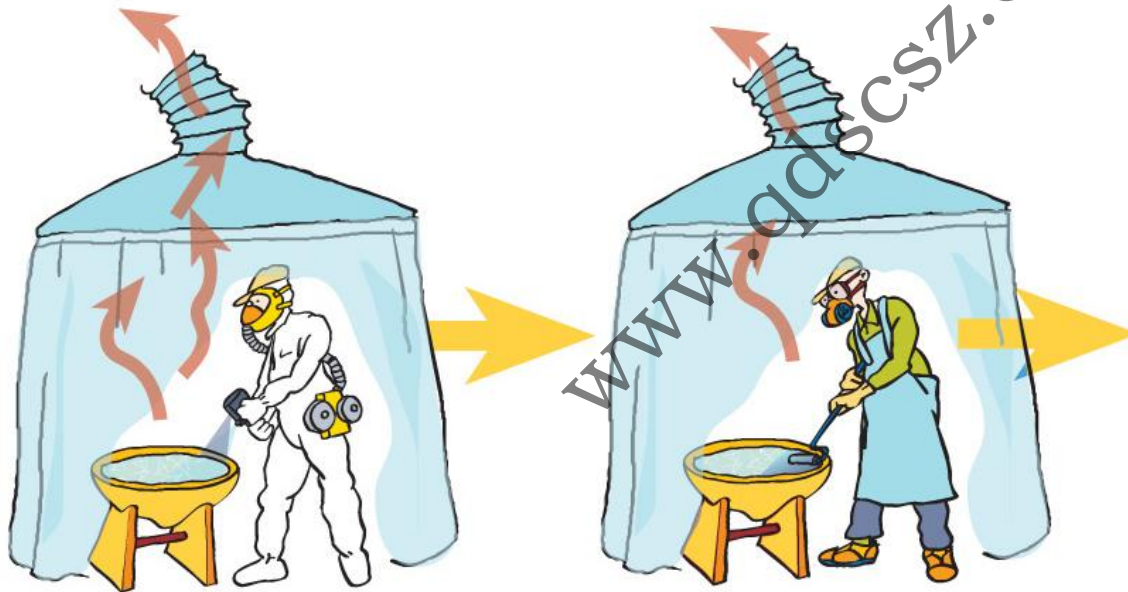
与普通树脂相比，总的苯乙烯挥发量减少35-50%，实际取决于施工方法，产品尺寸，形状和厚度。

使用亚什兰低挥发树脂在车间内制造大型部件可以显著降低苯乙烯的总挥发量
Working with LSE resins in a big tool in the work shop will decrease over all styrene emission



AROPOL® M 105 Low Styrene Emission (LSE) Resins

在喷房内使用低挥发树脂 –可以减少苯
已烯的总挥发量
**Working with LSE resins in a spray
booth - when more than one tool -will
decrease over all styrene emission**



由于苯乙烯挥发少，所以在层压后，小
模具可直接移到喷房外去固化
**After rolling out the laminate, a small
mold can be transferred outside the
spray booth for curing as emission is
very low.**

低挥发意味着节省树脂用量

Low styrene emission means saving resin

- w 苯乙烯挥发，取决于应用方法，普通树脂的挥发量为5-10%；
Styrene emission, depending on application method, when using standard resin is 5-10% of resin used.
- w 使用 AROPOL[™]低挥发树脂时，挥发量仅为树脂使用量的 2-5%；
By using Aropol LSE-resins, the emission is only 2-5% of resin used.
- w 平均节约树脂用量为 5%
The average savings in polyester resin is 5%.

高浸润技术

High wetting technology

W 高超的树脂合成技术使聚合物分子与苯乙烯有更好的相容性，获得更低的树脂粘度

Advanced resin polymerization technology provide excellent compatibility between resin and styrene, that deliver low resin viscosity.

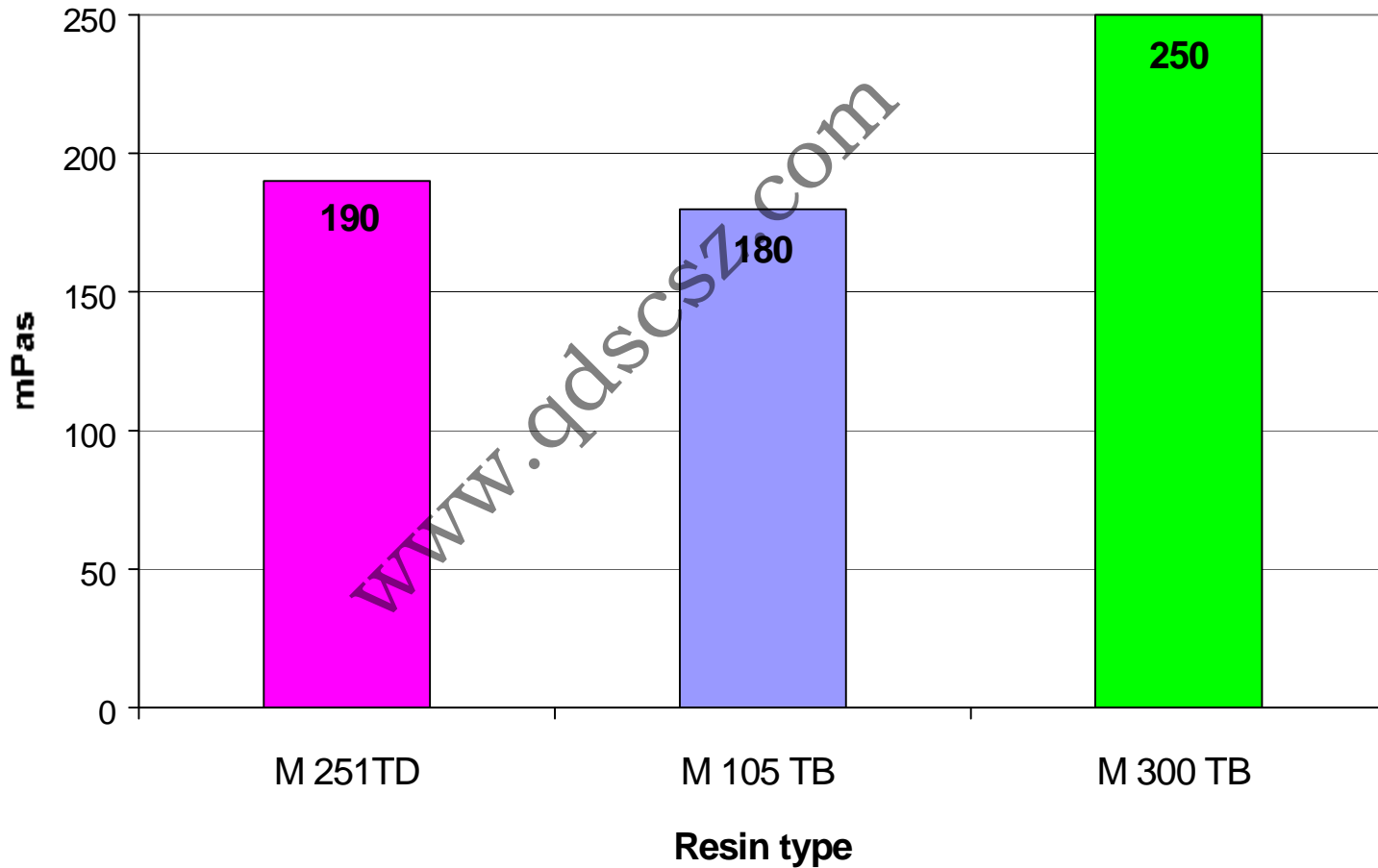
W 好的玻纤浸润性使树脂与玻纤结合更好，减少缺陷

Good fiber wetting out property result good combination of resin and fiber , reducing defect.

W 高的玻纤浸润性可提高玻璃纤维用量，减少树脂消耗

Good fiber wetting out property could increase fiber content, reduce resin consumption

AROPOLä树脂的粘度(23°C)/ AROPOLä resin's viscosity



提高玻纤含量就是节约的树脂

某客户使用普通树脂，玻纤含量为30%；当使用Aropol™低挥发树脂后，玻纤含量可增加到33%。

该客户原来每年树脂用量为 **10 吨.**

目前
30% 玻纤

$$\frac{\text{玻纤}}{\text{玻纤} + \text{树脂}} = 30\%$$

$$\frac{\text{玻纤}}{\text{玻纤} + 10 \text{ 吨}} = \frac{30}{100}$$

玻纤消耗量为
4.3 吨

用LE树脂后
33% 玻纤

$$\frac{\text{玻纤}}{\text{玻纤} + \text{树脂}} = 33\%$$

$$\frac{4.3 \text{ 吨}}{4.3 \text{ 吨} + \text{树脂}} = \frac{33}{100}$$

树脂消耗量为
8.7 tons

客户生产同样的产品，重量略轻，可节约 1.3 吨 (**13%**) 的树脂消耗量！

Higher fibre content means saving resin

EXAMPLE: A customer changing the glass fibre content in his products from 30% to 33%. Yearly resin consumption is 10 tons

Today
30% fibre

$$\frac{\text{Fibre}}{\text{Fibre + resin}} = 30\%$$

$$\frac{\text{Fibre}}{\text{Fibre + 10 tons}} = \frac{30}{100}$$

Standard resin
(Orthophthalic based)
integrated area 100 units

Tomorrow
33% fibre

$$\frac{\text{Fibre}}{\text{Fibre + resin}} = 33\%$$

$$\frac{4.3 \text{ tons}}{4.3 \text{ tons + resin}} = \frac{33}{100}$$

AROPOL
M 105 TB resin
integrated area 70 units

The customer produces the same products, a little lighter, and saves 1.3 tons (13%) in resin consumption.

AROPOL[®] M 105 Low Styrene Emission (LSE) Resins

使用AROPOL[™] 低挥发树脂总的树脂节约量

Use of LSE resins means saving in resin consumption and gives better laminates

- 低苯乙烯挥发节约所用树脂的 2~5%
2-5 % less resin thanks to lower styrene emission
- 高玻纤润湿性平均节约所用树脂的 10-15%
13% less resin thanks to good wetting properties

总计节约树脂是 12-20 %
Total saving is 15-20 %



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控制固化放热技术 Low peak exotherm technology

	M 105 TA	M 105 TAR	M 105 TB	M 105 TBR	M 105 TC	M 105 TCR
Gel time (min) 23°C 1% MEKP)	20	30	40	45	60	60
PET (°C) 23°C, 1% MEKP	120	100	110	80	80	80
Thickness of laminates (mm)	1-5	2-10	2-10	3-15	3-15	3-15

大大降低树脂固化放热峰，减少制品焦烧可能和热收缩，使一次成型较厚制件成为可能

Decrease peak exotherm significantly, reduce possibility of hot shrinkage. Allow thicker laminate wet on wet.

杯测浇注块试验/Resin casting test



- 试验条件/Test condition
 - 试验选用了目前亚什兰的M105TB和另二家国内主要树脂生产厂的船用树脂
M105 and two resin from local main supplier
 - 树脂用量为150g/杯
150g/cup
 - 固化剂用量为1.5%
MEKP content: 1.5%
- 试验结论/ Test results
 - M105(B杯)经过放热后没有任何开裂现象
The cup with M105 without any cracking.
 - 其它二种树脂明显开裂(A杯, C杯)
The two cup with other resin cracking significantly

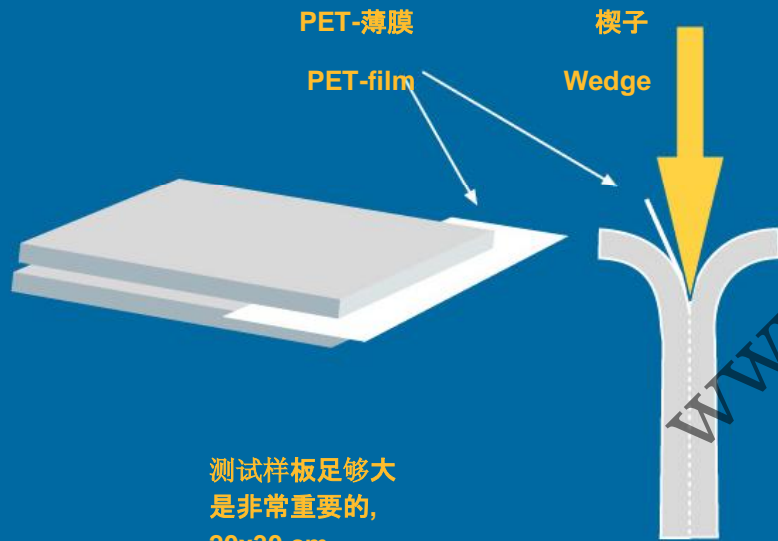
亚什兰低挥发树脂给客户带来什么？

- 独特的技术控制生产成本不提高树脂售价，LES树脂»普通树脂
- 低苯乙烯挥发改善工作环境，减少原材料损失
- 高浸润技术可提高纤维含量，减少缺陷，提高比强度
- 节省原材料费用达15-20%（通过减少苯乙烯挥发及提高纤维含量）
- 低放热使湿成型厚度达2-15mm，提高生产效率

AROPOL® M 105 Low Styrene Emission (LSE) Resins

通过检测撕裂强度和检测积层表面

Testing of adhesion properties by measuring separating force (kN) and inspecting laminates



测试样板足够大
是非常重要的,
20x30 cm

It is important to have
a large surface of test piece,
20x30 cm

试验过程:

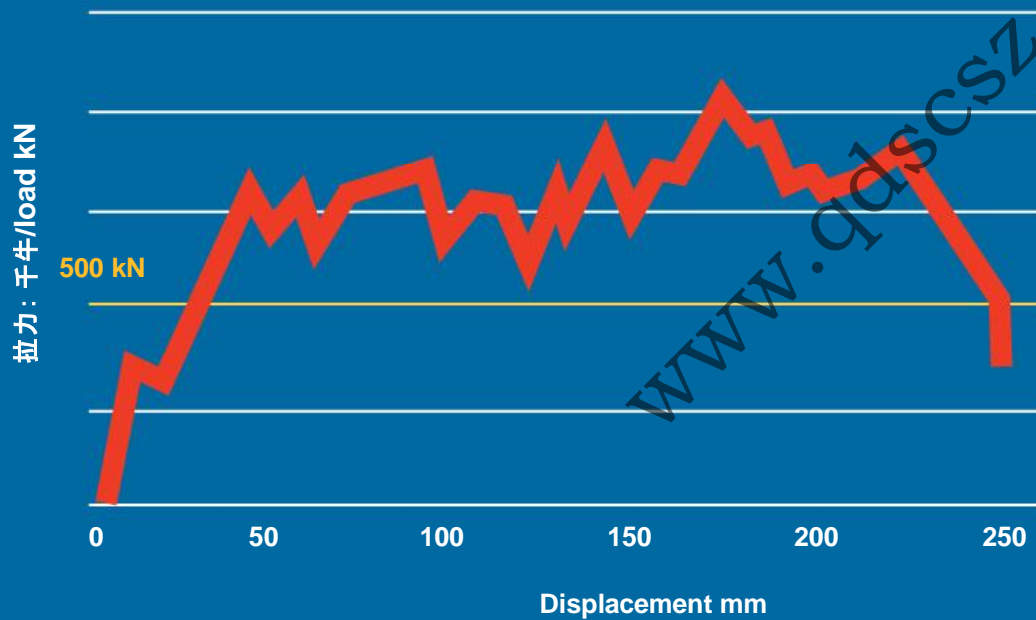
Preparation of the sample - extreme conditions:

- 用450 g/m²毡积三层, 固化剂用量是2%
Laminating resin rich preliminary layer with three plies of 450 g/m² emulsion bonded mat, using 2% catalyst
- 在23° C下固化三天/Allowing to cure for 3 day at 23° C
- 在原有积层上用450 g/m²毡积三层. 积层有部分区域用PET-膜分开
Laminating secondary layer with three plies of 450 g/m² mat on the top of the primary layer. Laminated layers are partially separated by PET-film
- 在23° C温度下固化一天/Allowing to cure for one day at 23° C
- 积层被用楔子分开
Laminates are separated using a wedge

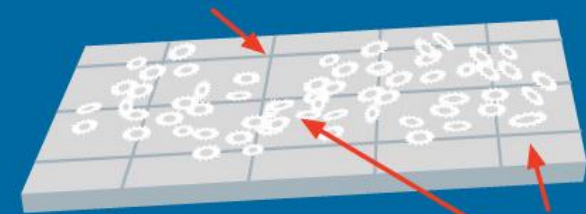
AROPOL[®] M 105 Low Styrene Emission (LSE) Resins

通过检测撕裂强度和检测积层表面

Testing of adhesion properties by measuring separating force (kN) and inspecting laminates



光亮表面/ Glossy surface



AROPOL M 105 树脂能保证优异的层间粘结

AROPOL M 105 resins ensure
an excellent interlaminar adhesion

AROPOL M 105 浇涛体的力学性能

Mechanical Properties of AROPOL M 105 casting

项目/property	值	单位	测试方法
拉伸强度/Tensile strength	55	Mpa	ISO 527
拉伸模量/Tensile moduls	3600	Mpa	ISO 527
断裂延伸率/Elongation at break	2	%	ISO 527
弯曲强度/Flexural strength	90	Mpa	ISO 178
弯曲模量/Flexural moduls	4100	Mpa	ISO 178
热变型温度/Heat deflection temperature	66	°C	ISO 75/2(A)

AROPOL M 105 积层板的力学性能

Mechanical Properties of AROPOL M 105 laminate*

项目/Property	单位	玻纤含量, 30%	玻纤含量, 33%
拉伸强度/Tensile strength	Mpa	80-100	100-120
拉伸模量/Tensile moduls	Mpa	7000-8500	8500-9500
断裂延伸率/Elongation at break	%	1.7-2.1	1.7-2.1
弯曲强度/Flexural strength	Mpa	160-190	190-220
弯曲模量/Flexural moduls	Mpa	6000-7000	7000-8000

•以短切毡积层4毫米。玻纤产品的类型和品质, 以及后固化温度会影响最终的测试结果
 Chopped strand mat laminate of 4 mm thickness. Type and quality of glass fibre and post curing temperature will influence final laminate properties.

在23·C温度下固化剂用量对凝胶时间的影响

Influence of catalyst amount to geltime at 23·C

M105树脂	1.0% MEKP-50	1.2% MEKP-50	2.0% MEKP-50
M105 TA	20 min	17 min	14 min
M105 TAR	25 min	20 min	17 min
M105 TB	40 min	32 min	25 min
M105 TBR	45 min	35 min	28 min
M105 TC	60 min	48 min	38 min
M105 TCR	60 min	48 min	38 min

AROPOL M 105 低挥发树脂性能

项目/Property	M105	TA	M105 TAR	M105 TB	M105 TBR	M105 TC
Viscosity Cone and plate/锥板粘度 (mPas)	180	180	180	180	180	180
Viscosity粘度, Brookfield(mPas)	1200	1200	1200	1200	1200	1200
Styrene content, 苯乙烯含量 (%)	41	41	41	41	41	41
Gel time, 凝胶时间, 1%MEKP-50(min)	20	30	40	45	60	
Peak exotherm, 放热峰 (°C) (100g树脂)	120	100	110	80	80	
Laminate thickness/积层厚度 (mm), 连续积层	1-5	2-10	2-10	3-15	3-15	

使用AROPO[®]L M105 低挥发树脂的优点

- 低的苯乙烯挥发量 / Low over all styrene emission
- 浸润性好易于施工 / Low viscosity and ease to work with
- 放热峰低可用于厚积层 / Low thermo peak and suit to thick laminating
- 好的机械性能 / Good mechanical properties
- 劳氏认证和DNV认证 / Lloyd's certificates and Det Norske Veritas Approved