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- High durability 高耐候性
- Super bluish undertone 超级蓝底相
- Outstanding dispersion 杰出分散性
- Excellent opacity 优异遮盖力

# DR-2589

*High durability plastic grade TiO<sub>2</sub>*  
高耐候性塑料级钛白粉

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Joint manufacture

## INTRODUCTION 产品介绍

DR-2589 is a specially designed plastic rutile grade with good durability. DR-2589 specialties are super bluish undertone, outstanding lightness in coloring and excellent opacity. The special inorganic treatment of dense amorphous silica and alumina protects the surface of TiO<sub>2</sub> from acting with polymers or additives. The organic surface treatment ensures DR-2589 outstanding dispersion, processability and low hygroscopicity in plastics production. The new treatment technology of DR-2589 can effectively improve the heat resistance, light fastness and weathering of plastics and keep them free from UV lights. So DR-2589 is enabling to improve the plastics mechanical property and also the insulation when used in cable.

DR-2589是一种专为塑料应用而设计的高耐候性金红石型钛白粉颜料。产品保持了DR-2588的超蓝底相色调、优秀的着色亮度和优异的遮盖力等性能。DR-2589特殊的致密无定形氧化硅和氧化铝表面处理像屏障一样保护钛白粉表面，避免与聚合物或添加剂发生反应，其特殊的有机表面处理确保了在塑料中杰出的分散性、优异的加工流动性能同时具有低吸湿性。采取新技术进行表面处理，提高塑料制品的耐热、耐光、耐候性能，使塑料制品免受UV光的侵袭，改善塑料制品的机械性能和电性能。

Property/参数	Typical value/典型值
TiO <sub>2</sub> content, % TiO <sub>2</sub> 含量, %	94.0
Inorganic treatment 无机表面处理物	Al <sub>2</sub> O <sub>3</sub> ·nH <sub>2</sub> O SiO <sub>2</sub> ·nH <sub>2</sub> O
Organic treatment 有机表面处理物	Organic silicon/有机硅
Oil absorption, g/100g pigment 吸油量, g/100g颜料	18
Loss at 105 °C, % 105°C挥发物, %	0.1
<sup>1</sup> Color in white PVC-P(L*) 在白色PVC-P中的颜色 (L*)	97.5
<sup>2</sup> Tinting strength in grey PVC-P(compared with STD) 在灰色PVC-P中的消色力 (与标准样品比)	100
<sup>2</sup> Undertone in grey PVC-P 在灰色PVC-P中的着色底相	17.0
<sup>3</sup> Melt flow rate (MFR), g/10min 熔体质量流动速率 (MFR), g/10min	23.0
<sup>4</sup> Filtration pressure value (FPV), bar/g 过滤压力值 (FPV), bar/g	0.200
<sup>5</sup> Volatile at high temperature(300 °C), % 高温挥发份(300°C), %	0.3
Specific gravity, g/cm <sup>3</sup> 真密度, g/cm <sup>3</sup>	4.0
International Standard Classification ISO 591 国际标准ISO591分类	R2
USA MRS Standard Classification ASTM D476 美国材料试验学会ASTM D476分类	VII

### NOTE/注:

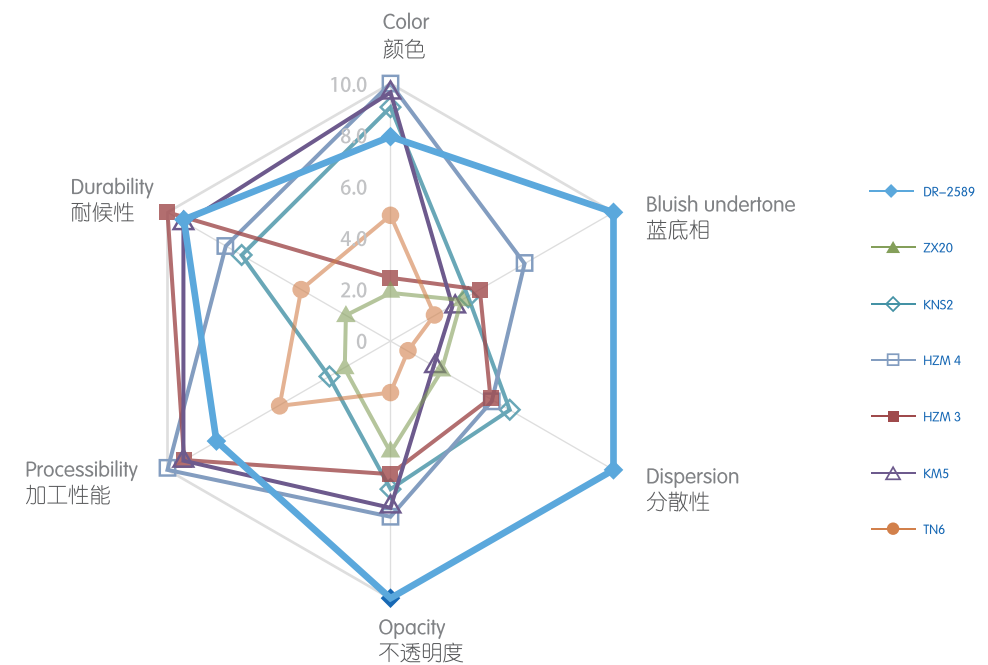
- Test in white PVC-P containing plasticizer. TiO<sub>2</sub> content is 4PHR.
- Test in grey PVC-P containing plasticizer and carbon black. TiO<sub>2</sub> content is 4PHR.
- Test in master batch made of TiO<sub>2</sub> and LLDPE (MFR is 25g/10min) mixture. TiO<sub>2</sub> content is 70%.
- Following the European Standard ISO23900-5:2015, LDPE as the base resin, dilute the master batch TiO<sub>2</sub> content from 70% to 8% to test FPV (Filtration Pressure Value).
- After the test of loss at 105°C, put the sample into constant temperature oven at 300°C for 2hrs and weigh the reduction.

- 在钛白粉含量为4PHR的含增塑剂聚氯乙烯体系 (PVC-P) 中测试。
- 在钛白粉含量为4PHR的含增塑剂和炭黑的聚氯乙烯体系 (PVC-P) 中测试。
- 在钛白粉含量为70%的线性低密度聚乙烯 (熔融指数为25g/10min) 色母粒中检测。
- 钛白粉含量为70%的线性低密度聚乙烯色母粒采用低密度聚乙烯 (LDPE) 作为基础树脂进行稀释, 按照ISO23900-5:2015标准检测。
- 钛白粉检测完105°C挥发物后, 放入300°C恒温的烘箱中加热2hr, 检测加热减量。

## SPECIAL FEATURES 产品特性

- Super bluish undertone and high tinting strength
- Outstanding dispersion
- Top-level opacity among high durability products
- Excellent processability
- Super low volatile at high temperature
- Good heat stability
- Super high durability & outstanding chalking resistance

- 领先于行业内的超级蓝底相和高消色力
- 杰出的分散性
- 同级高耐候产品中突出的遮盖能力
- 优异的加工流动性
- 低高温挥发分
- 优秀的耐热稳定性能
- 超高耐候性能和杰出的抗粉化性能



### NOTE/注:

0—Worst, 10—Best, All listed are high durability plastic grades.  
0—最差, 10—最好, 列举产品均为塑料级高耐候产品。

## MAIN APPLICATIONS 主要应用

DR-2589 is recommended to be used in various outdoor plastic applications which need to resist UV degradation, such as:  
DR-2589推荐用于各类户外需要抵抗紫外线降解的塑料应用, 如:

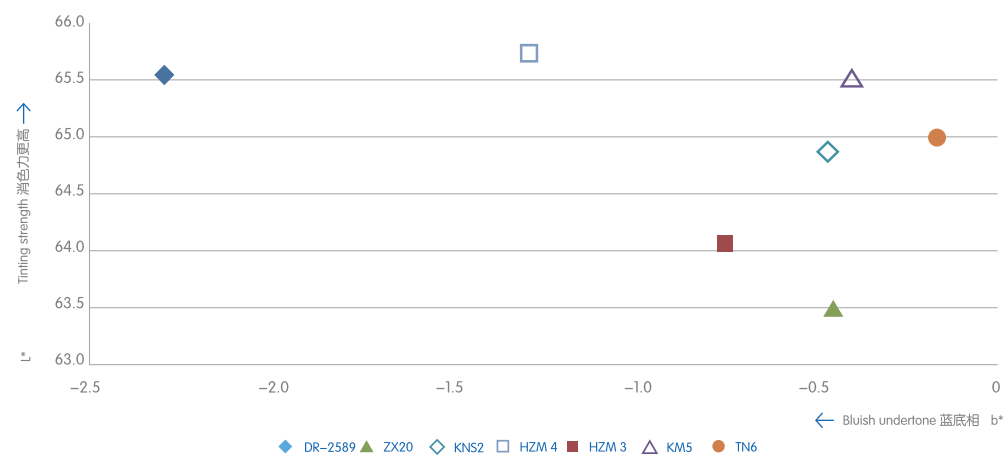
- PVC calendaring, door and window profiles, fencing and flooring
- High performance external plastic pipe
- Agricultural film
- PVC, PE and PP furniture

- PVC压延、门窗型材、围栏和地板
- 各类高性能户外塑料管材
- 农用薄膜
- PVC、PE和PP家具

## SUPER BLUISH UNDERTONE AND HIGH TINTING STRENGTH 领先于行业内的超级蓝底相和高消色力

- Tinting strength and undertone are tested in grey PVC containing plasticizer.
  - Benefited by the fine particle size and concentrated particle size distribution, DR-2589 is enabled to have a very good tinting strength and super bluish undertone.
  - The super bluish undertone will eliminate the natural yellow color of resin so to get a more bright and pleasant color. It can reduce the usage of ultramarine or phthalocyanine blue to obtain better economic benefits.
  - It has more particles in a unit weight benefited by its tiny particle size. With the advantage of good dispersion, DR-2589 is easier to get a better hiding power and dilution effect.
- 在含增塑剂的灰色聚氯乙烯树脂(PVC)中测试消色力和底相。
  - 得益于集中的粒径分布和较细的晶粒尺寸, DR-2589具有领先同级别高耐候产品的超级蓝底相和出众的消色力。
  - 超蓝底相可以轻易的消除树脂中天然的黄色相, 树脂本身色相越黄, 效果越好, 帮助塑料获得更明亮和令人愉悦的颜色, 同时减少群青或酞菁蓝的使用, 获得更佳的经济效益。
  - 较细的晶粒尺寸使得同等质量下的钛白粉拥有更多数目的粒子, 在良好的分散帮助下, 可以获得更优秀的遮盖力和冲淡能力。

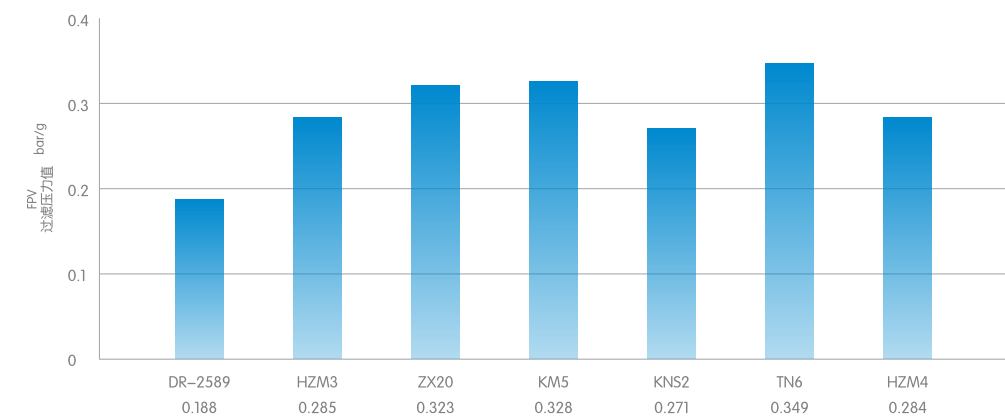
Undertone and tinting strength in grey PVC-P (TiO<sub>2</sub> content:4PHR)  
在PVC-P (灰色) 中的底相和着色力 (钛白粉含量: 4PHR)



## OUTSTANDING DISPERSION 杰出的分散性

- Make DR-2589 and LLDPE mixture into master batch by twin screw extruder. DR-2589 content in MB is 70%. Following the international standard ISO23900-5:2015, LDPE as the base resin, dilute the master batch and lower the TiO<sub>2</sub> content to 8% to test FPV (Filtration Pressure Value).
  - Screen 3# refers to 3# filters (10μm) required by international standards.
  - The contrast samples are all master batch made from high durability TiO<sub>2</sub>. As shown on the chart DR-2589 has better dispersion.
  - DR-2589 has an advantageous dispersion and very low coarse particle content which are benefited by the efficient removal of the coarse particles, excellent surface treatment.
- 采用双螺杆挤出机将DR-2589和线性低密度聚乙烯(LLDPE), 混合制成70%浓度色母粒, 按照国际标准ISO23900-5:2015的要求, 采用低密度聚乙烯(LDPE)作为基础树脂将色母粒稀释成含有8%的钛白粉浓度的混合料, 检测过滤压力值(FPV)。
  - Screen 3#是指采用国际标准要求的3#过滤网(孔径约10μm)。
  - 对比样品均为高耐候塑料级钛白粉制成的色母粒, 具有较好的分散性。
  - 得益于DR-2589高效的粗粒子去除技术和优秀的表面处理技术, DR-2589具有极具竞争力的分散性和极低的粗粒子含量。

Filtration Pressure Value(FPV) Test under international standard ISO23900-5:2015  
过滤压力值(FPV) (按照国际标准ISO 23900-5:2015检测)



NOTE/注:  
Low FPV=good dispersion 低FPV=分散性良好

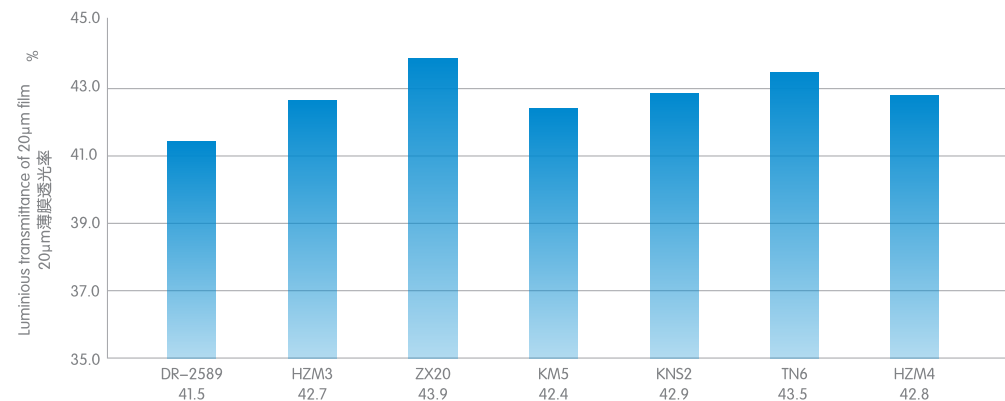


## TOP-LEVEL OPACITY AMONG HIGH DURABILITY PRODUCTS

### 同级高耐候产品中突出的遮盖能力

- Make DR-2589 and LLDPE mixture into master batch by twin screw extruder. DR-2589 content in MB is 70%. LDPE as the base resin, dilute the master batch and lower the TiO<sub>2</sub> content to 8% and make into 20μm plastic film in blowing machine. This follows the ASTM D1003-13 to test the transmittance.
- High luminous transmittance means poor hiding power. In this case, it needs more TiO<sub>2</sub> to reach the ideal opacity. Generally, the high opacity of the film made with TiO<sub>2</sub> means high haze. The greenhouse film made with DR-2589 can scatter lights by a large margin. It provides even solar radiation to the plants.
- DR-2589 can be fully dispersed in the carrier, showing excellent opacity which is benefited by the excellent surface treatment and dispersion. Compared with other high durability products, DR-2589 is less needed to achieve the required opacity so DR-2589 can bring down the cost and greatly reduce the TiO<sub>2</sub> impact on the mechanical properties of plastics.
- 采用双螺杆挤出机将钛白粉的线性低密度聚乙烯(LLDPE)混合制成70%浓度的色母,然后将色母粒与低密度聚乙烯(LDPE)混合在吹膜机上吹成钛白粉含量为8%,厚度20μm的薄膜,按照美国材料试验学会标准ASTM D1003-13检测透光率。
- 透光率高则产品遮盖力差,也意味着需要更多的钛白粉来达到同样的不透明度,通常添加钛白粉制成的薄膜不透明度高也意味着雾度大,用来制成大棚薄膜,可以将光线大幅度的进行散射,为大棚中的植物提供均匀的太阳辐射。
- 得益于DR-2589优秀的表面处理、杰出的分散性,DR-2589可以充分的细化分散在载体中,展现出优异的遮盖力。相对于其他耐候型产品,可以减少钛白粉用量达到需要的不透明度,从而节约成本,并且将钛白粉对塑料的力学性能影响大幅度降低。

Transmittance in plastic film Test under the USA MRS ASTM D1003-13  
透光率(按照美国材料试验学会标准ASTM D1003-13检测)



**NOTE/注:**

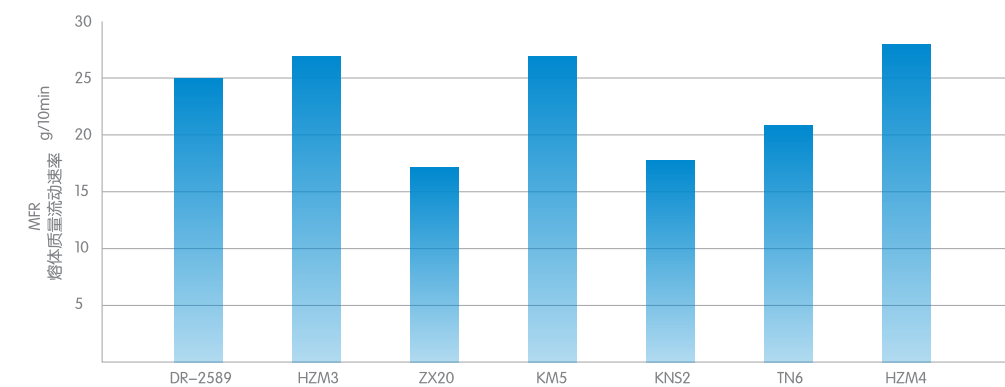
Low transmittance=good opacity 低透光率=遮盖力好

## EXCELLENT PROCESSIBILITY

### 优异的加工流动性

- Make 70% content masterbatch by twin screw extruder out of DR-2589 and LLDPE (MFR=25g/10mins). Test the melt flow rate under the ISO11133-1:2011. Temperature is 190 °C, load is set as 2.16kg.
- TiO<sub>2</sub> with high MFR has a good processibility. When mixed with resin, it can efficiently lower the machine torque to save energy and increase the productivity. It's beneficial to obtain more ideal shape and perfect surface effect during injection as well.
- Benefited by the excellent surface treatment of DR-2589, high MFR can be obtained by easy wetting and dispersion during processing, which is an advantage in plastic applications.
- 采用双螺杆挤出机将钛白粉与MFR为25g/10min的线性低密度聚乙烯(LLDPE)混合制成70%浓度的色母粒,按照ISO1133-1:2011标准检测熔体质量流动速率(MFR),检测参数设定:温度为190°C,负荷为2.16kg。
- MFR高的产品具有良好的加工流动性,与树脂混合熔融加工时能有效降低机器扭矩从而降低能耗和提高生产速度。同时利于注塑时获得更理想的形状和完美的表面效果。
- 得益于DR-2589独特的表面处理使其在加工过程中易润湿分散,从而获得优秀的MFR,在塑料应用中极具竞争力。

Melting flow rate(MFR) Test under IOS1133-1:2011  
熔体质量流动速率(MFR)(按照ISO1133-1:2011标准检测)

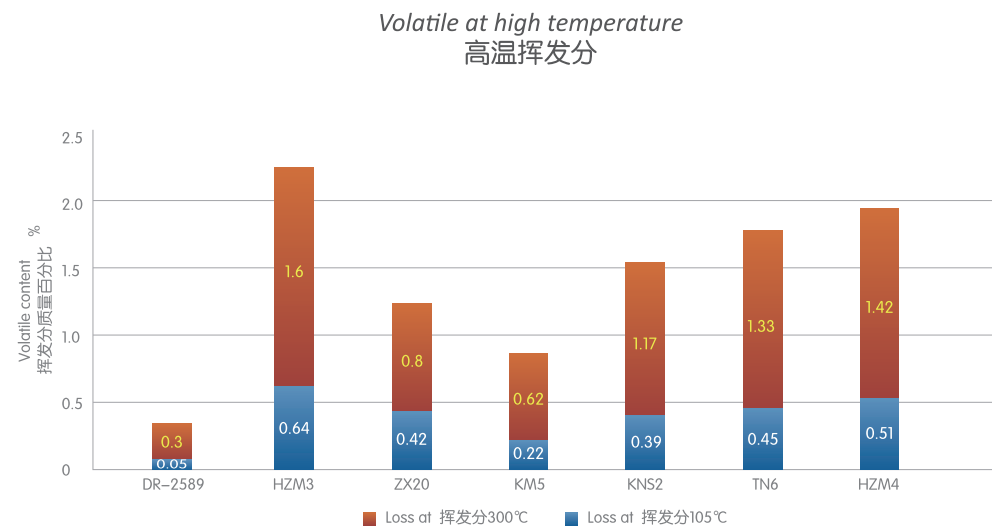


**NOTE/注:**

High MFR=good flowability 高MFR=流动性好

## LOW VOLATILE 低高温挥发分

- The value of loss at 105 °C depends on the humidity in the air and the storage time. If the surface treatment is flawed or the hydrophilic group is used for organic treatment, the value will be much higher than the average level of plastic grade TiO<sub>2</sub>. The lower loss at 105 °C means better surface treatment.
- Benefited by DR-2589's excellent inorganic and organic surface treatment, it not only ensures excellent dispersion, but also achieves extremely low volatile.
- The low volatile is essential for plastics processing at high temperature. It is also necessary for the healthy usage of food contact materials.
- The low volatile can effectively eliminate the cracks and striations. Those are defects in plastic products under high temperature processing.
- 105°C挥发分的数值意味着钛白粉表面的吸附水,取决于空气中的湿度和储存时间,如若表面处理异常或使用了含亲水基团的有机处理时,该数值会远高于塑料级钛白粉的平均水平,较低的105°C挥发分亦意味着表面处理良好。
- 得益于DR-2589优秀的无机表面处理技术和有机表面处理技术,不但保证了杰出的分散性同时达到了极低的高温挥发分。
- 低高温挥发分是满足塑料高温加工的必须要求,同时也是食品材料健康使用的必要前提。
- 低高温挥发分的钛白粉在高温加工时可以有效的避免产生塑料制品的裂孔、纹路等缺陷。



### NOTE/注:

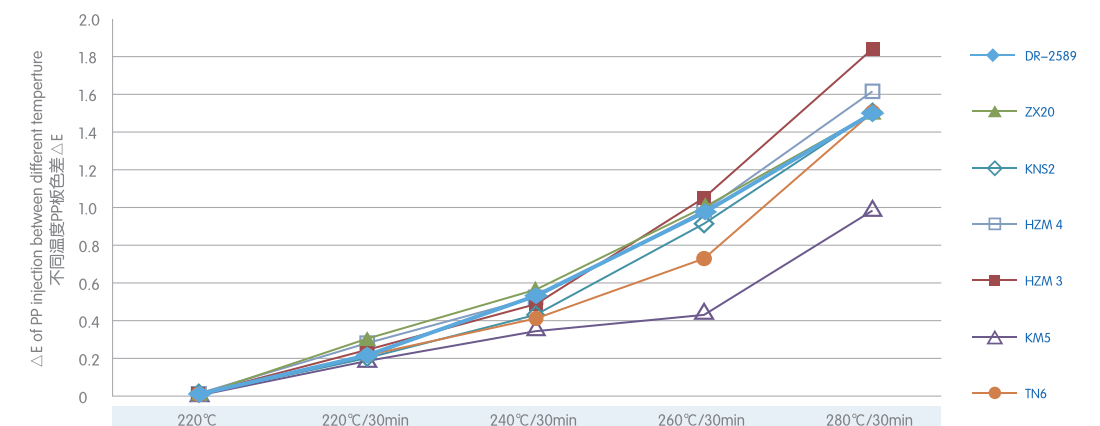
Low volatile at 105°C=low moisture 较低的105°C挥发分=水分少

Low volatile at 300°C=good heat stability of organic treatment 较低的300°C挥发分=有机表面处理热稳定性好

## GOOD HEAT STABILITY 优秀的耐热稳定性能

- Color change resistance in PP injection: Mix 70%( TiO<sub>2</sub> content) master batch and polypropylene, injected at 220°C and test the injected chip's color by a spectrophotometer. And then the chips stay at 220°C, 240°C, 260°C and 280°C for 30 minutes respectively and inject, test the panel color and calculate the color difference.
- The effective control of impurity content, excellent inorganic surface treatment and organics coating technology enable DR-2589 has not only high durability but also excellent heat stability.
- DR-2589 excellent heat stability and low moisture absorption can satisfy the injection at high temperature.
- 在PP注塑中的耐变色性能:70%钛白粉含量的色母粒与聚丙烯混合,在220°C温度下注塑,注塑板采用色差计测定初始颜色,然后在220°C、240°C、260°C和280°C停留30min后注塑并测定颜色,计算色差。
- 得益于对杂质含量的有效控制、优秀的无机表面处理和有机包覆技术,DR-2589不但拥有超高的耐候性能同时兼具了优秀的耐热变色性能。
- DR-2589良好的热稳定性和低挥发分可以注塑高温加工的高要求。

**Heat stability in PP injection  
(Stay for 30mins in single screw)  
在PP注塑中的耐热变色性能(在单螺杆中停留30min)**



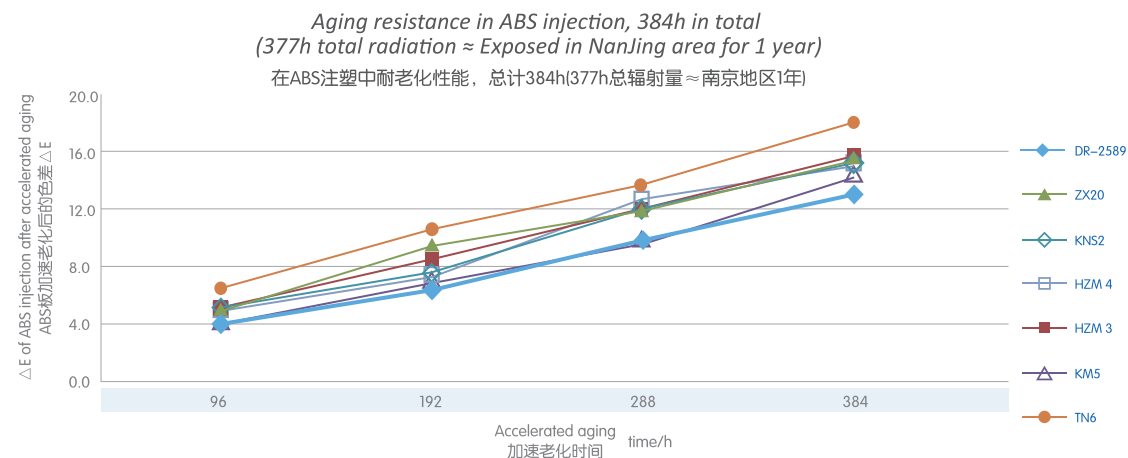
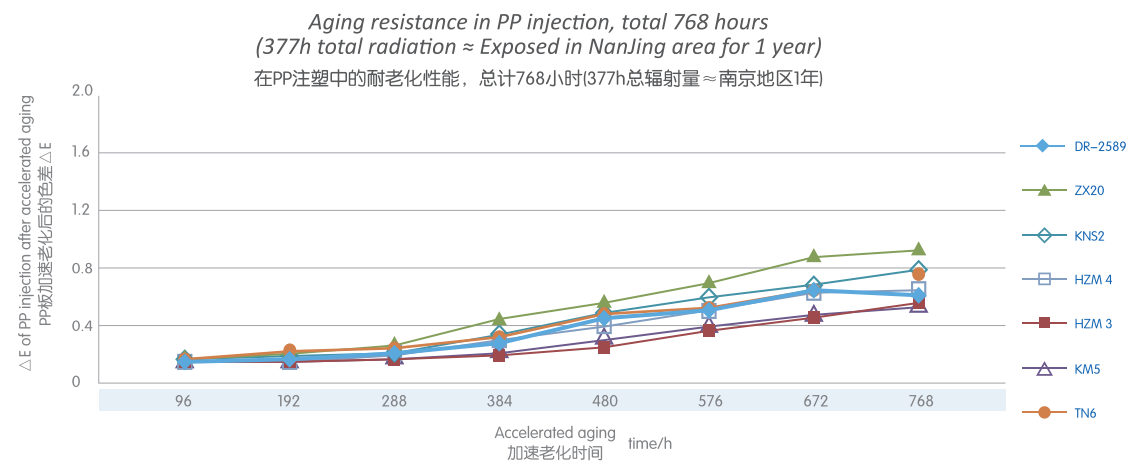
### NOTE/注:

Small ΔE=excellent heat stability 较小色差值ΔE=优秀的耐热稳定性能

## SUPER HIGH DURABILITY & OUTSTANDING CHALKING RESISTANCE

### 超高耐候性能和杰出的抗粉化性能

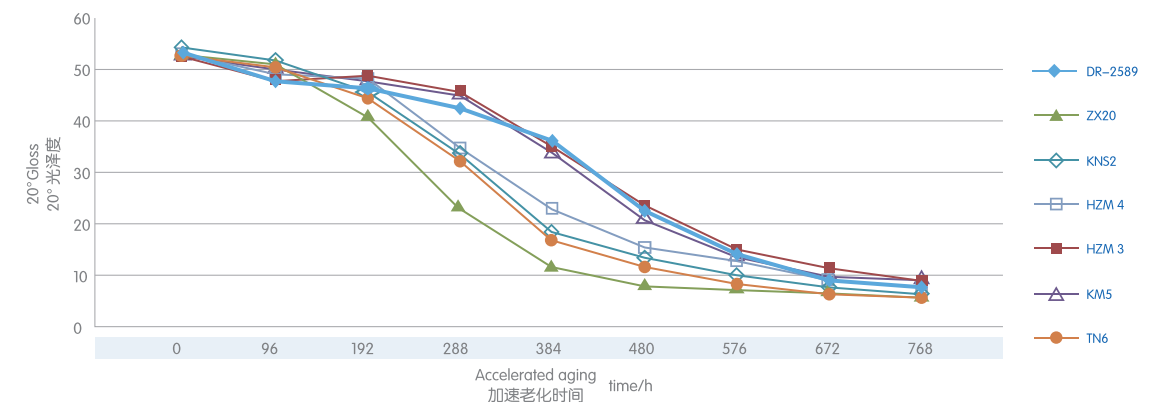
- Durability in PP injected chip: Mix 70% (TiO2 content) master batch and polypropylene into 5% TiO2 compound, inject at 220°C. (If in ABS, inject at 230°C.) . Test the injected chip's color by a spectrophotometer then put it into aging oven. Following the ISO 4892-3:2016 as standard, use light source UVA-340 with a radioactivity of 0.89W\*m-2\*nm-1, 8 hours of exposure, 4 hours of condensation, stands on 12-hours cycle, test ΔE every 96h.
- 在注塑板中的耐候性能: 色母粒(70%钛白粉含量)与树脂混合成5%钛白粉含量的混合物, PP在220°C温度下注塑, ABS在230°C温度下注塑。注塑板采用色差计测定初始颜色, 然后放入老化箱中, 按照国际标准ISO 4892-3:2016标准测试, 采用UVA-340灯组, 0.89W\*m-2\*nm-1辐照度, 8小时曝露, 4小时凝露, 即12小时作为一个循环进行测试, 每96h测试一次色差的变化。
- Benefited by excellent inorganic and organic surface treatment, DR-2589 offers excellent color change resistance among the high durability PP products which is far superior to indoor application TiO2 even in low durability ABS.
- 得益于独特的无机表面处理和有机包覆, DR-2589在耐候型PP产品中抗变色能力处于上游水平, 远优于室内应用的钛白粉, 在耐候性较差的ABS中, 耐紫外黄变能力更加卓越。



NOTE/注:  
Small ΔE=better durability 低色差值ΔE=更佳的耐候性

- Benefited by excellent surface treatment and particle size control, DR-2589 owns excellent gloss and high chalking resistance which makes the products stay bright for a long time.
- 得益于优秀的表面处理和均匀的粒径控制, DR-2589拥有优异的光泽和高度抗粉化能力, 让制品长时间保持出明亮的光泽和鲜艳的色彩。

Loss of gloss (chalking resistance) performance in PP injection.  
在PP注塑中的失光率(抗粉化)性能



NOTE/注:  
High gloss=low chalking 高光泽度=低粉化

Grade / 20° Gloss 牌号 / 20° 光泽度	Accelerated aging time/h 加速老化时间									
	0	96	192	288	384	480	576	672	768	
DR-2589	52.8	47.8	46.5	42.0	36.7	21.5	14.2	9.3	8.2	
ZX20	52.8	51.6	40.9	23.4	11.6	8.2	7.2	6.7	5.9	
KNS2	53.9	52.2	46.1	33.4	18.3	13.0	10.2	7.9	7.2	
HZM4	52.8	49.3	48.3	34.8	22.5	14.9	12.9	9.4	8.0	
HZM3	25.5	48.2	49.1	45.5	35.3	22.8	15.0	11.7	8.8	
KM5	52.6	50.5	48.2	45.1	34.5	20.7	14.2	10.4	9.6	
TN6	52.3	50.6	44.5	31.8	16.7	11.4	8.6	6.3	5.6	