

脂肪族聚酮

特性和应用

HYOSUNG POK China Biz. Division

Agenda

I. 晓星的介绍

II. 聚酮是什么

III. 特性和应用

VI. 现在和未来

晓星集团介绍



HYOSUNG Group 晓星集团

晓星致力于工业和技术的各个领域，以使您的生活更加便捷和舒适

- 2015年销售额110亿美元
- 7大事业领域：纤维, 产业材料, 重工业, 化学(PP/ TPA/ NF3 /PK), 建筑, 贸易, 情报通信
- 氨纶纤维, 帘子布（全球第一）



TEXTILE



INDUSTRIAL MATERIALS



CHEMICALS



POWER & INDUSTRIAL SYSTEMS



CONSTRUCTION



TRADING



INFORMATION & COMMUNICATION



OTHER AFFILIATED COMPANIES



History of HYOSUNG's Engineering Plastic Business

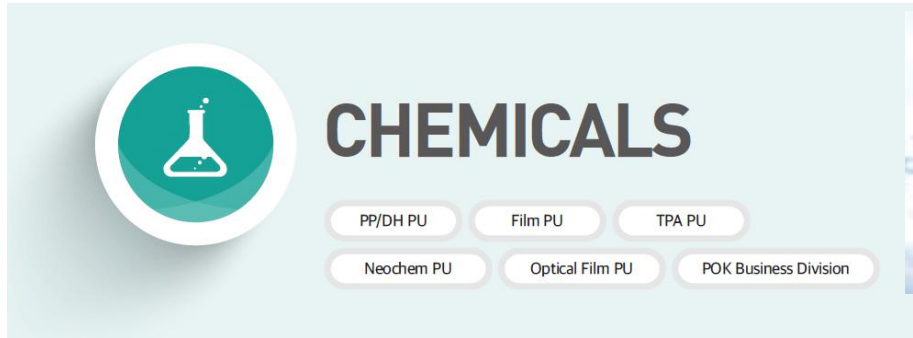
晓星工程塑料事业的历史

- **1978** **Established Tongyang Nylon Enpla Business Unit** 东洋尼龙
- **1980** **Established HYOSUNG-BASF Enpla** 晓星-巴斯夫
- **1987** **Established Korean Engineering Plastics** 韩国工程塑料
- POM and POM Compound
- **1998** **Restructured ENPLA Business** 重组工程塑料业务
- Sold KEP, HYOSUNG-BASF, Tongyang Nylon Enpla Business Unit
- **2004~** **Started Poketone R&D** 开始研发
- **2015** **Established Poketone Commercial Plant** 开始商业化生产

**HYOSUNG is going to open New Horizon of Enpla Business
with Poketone** 晓星正在用聚酮打开工程塑料的新纪元

晓星-化学事业部

- 提供品种广泛的化学产品，比如聚丙烯，TPA（对苯二甲酸），各种类型的薄膜和氟气体等，大量出口到亚洲，欧洲和中东市场
- 晓星是第一个开发脂肪族聚酮并成功实现商业化的公司，PK将凭借其优异的物理及化学性能和综合的竞争优势，在全球市场成为核心的应用材料之一



I. 晓星介绍

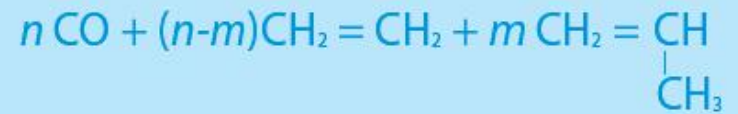
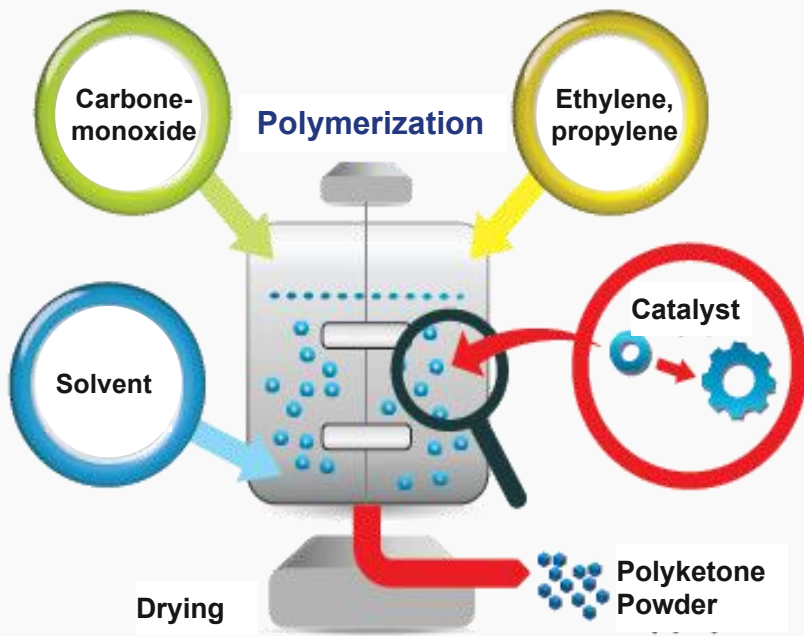
II. 聚酮是什么

III. 特性和应用

VI. 现在和未来

II. 聚酮是什么

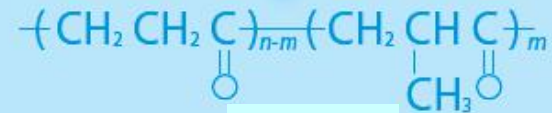
- 新的绿色环保型聚合物，它由一氧化碳和烯烃（乙烯，丙烯）聚合而成
- 合成物
 - ENPLA 三聚物 (一氧化碳 + 乙烯 + 丙烯)
 - Super Fiber 共聚物 (一氧化碳 + 乙烯)



Carbon-monoxide

Ethylene

Propylene



Polyketone



II. 聚酮是什么

聚酮优异和宽泛的性能表现，使它成为一款“天然”的热塑性工程塑料

- 绿色环保，不含有害物质
- 在较宽的应用环境温度下，具有优异的抗冲击性能
- 出色的耐化学，耐燃油性和耐水解性
- 优异的耐磨性
- 低透水率和气体阻隔性

I. 晓星介绍

II. 聚酮是什么

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III. 特性和应用-绿色环保，不含有害物质

1

“新的绿色环保聚合物材料”

- 主要由一氧化碳合成，而一氧化碳是大气的主要污染源之一
- 不含有害物质 (比如甲醛..)

* Major 6 Air Pollution Source : CO, NOx, SOx, NH3, VOC, PM

聚酮 50,000MT

一氧化碳消耗 25,000MT.

在韩国的大气污染的排放：3.68 百万公吨

▪ NOx	28.8%	二氧化氮
▪ VOC	23.5%	有机挥发物
▪ CO	20.9%	一氧化碳
▪ SOx	10.9%	二氧化硫
▪ NH3	7.9%	氨气
▪ TSP	4.8%	总悬浮颗粒
▪ PM10	3.2%	直径 10 μ m的颗粒

相当于**3.8**百万棵松树的净化效果
一棵**30**年长的松树每年可净化**6.6kg**的二氧化碳



来源：韩国国家环境研究所

聚酮生产用的一氧化碳，主要来自氢，钢铁，煤的制造工业

III. 특性和应用 - 绿色环保, 不含有害物质

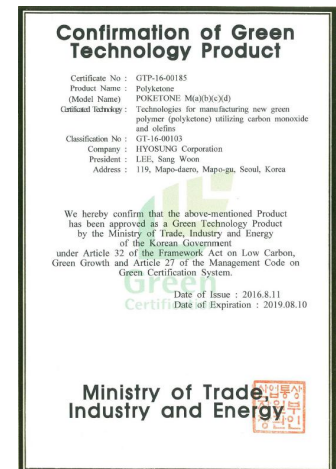
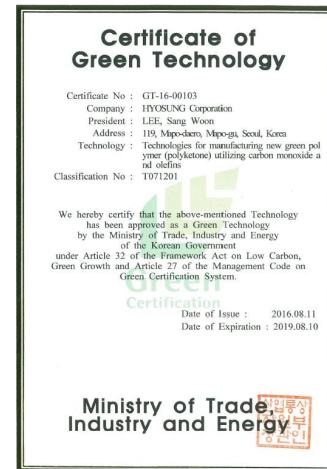
- POKETONE can be a great option for solving Formaldehyde issue of POM

► POKETONE Base Resin Test Report (by 3rd Party)

Tedlar bag size / Sampling Volume			3 L / 1.5 L (N2)		
Analysis Conditions			65 °C , 2h		
Analytes	Test Method	Unit	MDL	Limit	Results
Formaldehyde	MS 300-55:2014, DNPH Cartridge, HPLC	µg/m ³	20	210	N.D.
Acetaldehyde	MS 300-55:2014, DNPH Cartridge, HPLC	µg/m ³	20	50	N.D.
Acrolein (=Acrylaldehyde)	MS 300-55:2014, DNPH Cartridge, HPLC	µg/m ³	20	50	N.D.

► PK vs POM Formaldehyde Migration Test (HYOSUNG R&D Center)

Material	Unit	Migration
POM	ppm	0.30
PK	ppm	0.00



► Ecofriendly Material (Green Certification)

Green Certification : System to certify and support

“Green Technologies”

based on “The basic act on low carbon green growth”

III.特性和应用-绿色环保，不含有害物质

水处理应用

特性

- 未检测出甲醛
- 耐水解
- 耐化学性

- 相关认证
NSF/ANSI 61
各国的甲醛含量规范



净水器头顶连接件



厨房附件



Water Cartridge



花洒头



净水器配件



Pipe Fitting Cap

* 正在开发中

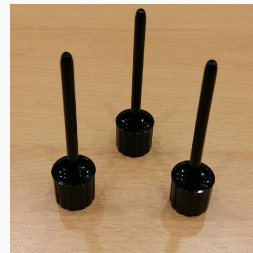
III.特性和应用-绿色环保，不含有害物质

化妆品包装

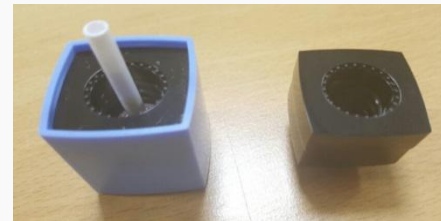
特性

- 未检测出甲醛含量
- 耐水解
- 耐化学性
- 气体阻隔性

- 相关认证
甲醛含量的各国标准



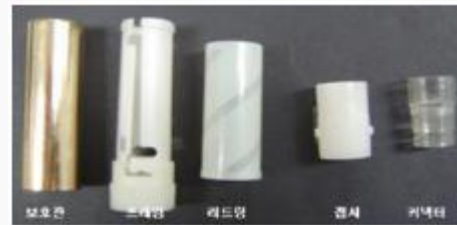
Mascara Stick



Lip Tint Cap Inner



Tension Plate



口红棒防漏



Cushion Plate

* 正在开发中.

III. 特性和应用-在较宽泛环境温度下，具有优异的抗冲击性能

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“高抗冲击性能”

- 抗冲击强度比Nylon, PBT高230%
- 由于优良的耐水解性，在潮湿的环境下，抗冲击性不会降低

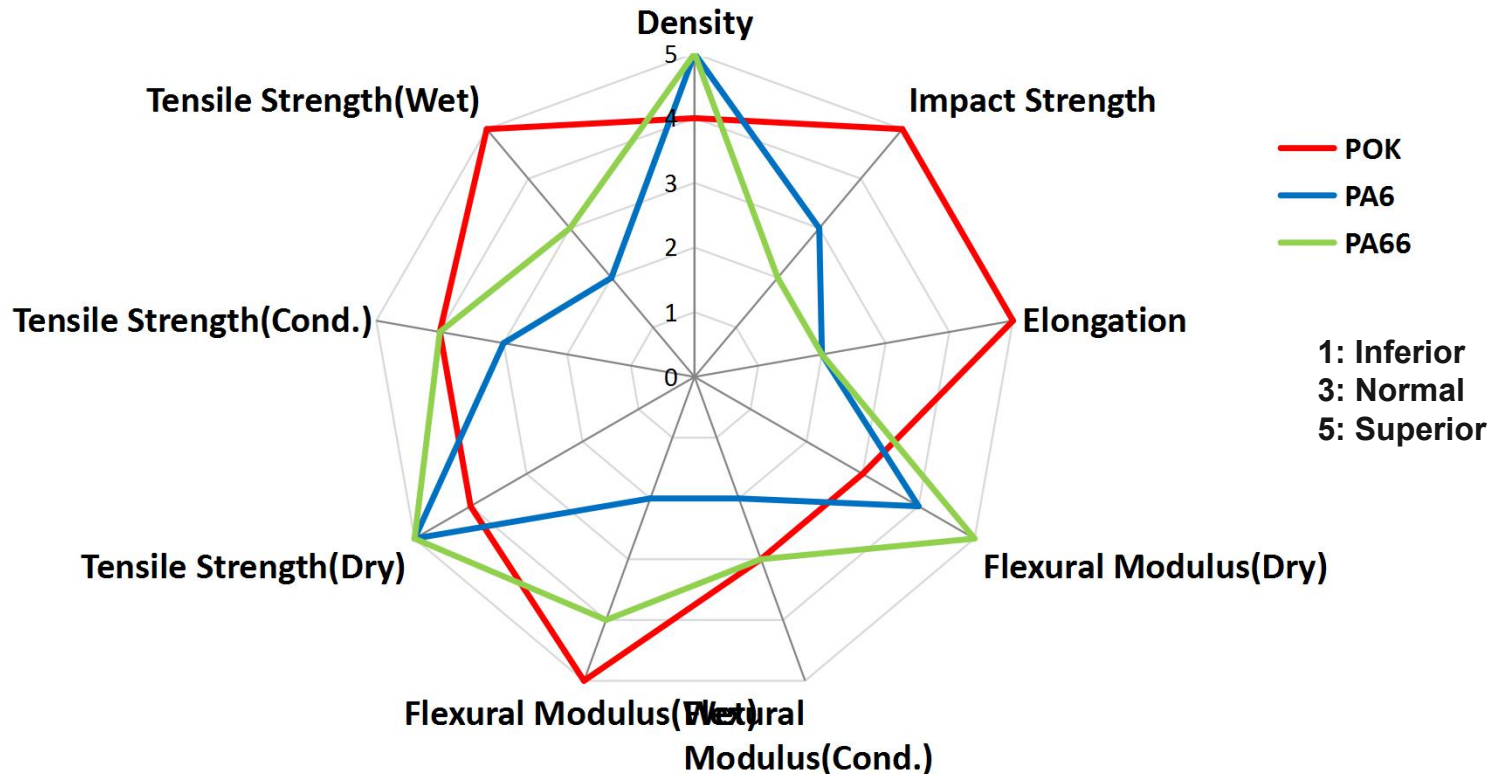
Items		Unit	POK	PA6	PA66	PBT	POM
Density密度		g/cm ³	1.24	1.14	1.14	1.30	1.41
Melting Temperature熔点		°C	220	220	260	220	160
Impact Strength 冲击强度		KJ/m ²	9.0	5.2	4.1	5.0	6.5
Tensile Strength 拉伸强度	Dry	MPa	60	80	80	55	65
	Conditioned		60	55	70	-	-
	Wet		50	35	50	-	-
Elongation at Break 断裂延伸率	Dry	%	270	17	19	16	35
	Conditioned		270	40	60	-	-
	Wet		390	360	370	-	-
Flexural Modulus 弯曲模量	Dry	MPa	1,500	2,600	2,900	2,400	2,500
	Conditioned		1,500	1,200	2,200	-	-
	Wet		1,250	600	1,100	-	-

* Dry: 23°C, 50% RH, 24hrs Conditioned: 23°C, 50% RH, 60days Wet: 23°C, 90% RH, 60days

** POK : Hyosung M330A properties.

III.特性和应用-在较宽泛环境温度下，具有优异的抗冲击性能

通常，尼龙具有高刚性，但抗冲击强度和延伸率偏低，但聚酮在保持良好刚性的情况下，同时具有优异的抗冲击性能和抗冲击性能



* Dry: 23°C, 50% RH, 24hrs Conditioned: 23°C, 50% RH, 60days Wet: 23°C, 90% RH, 60days

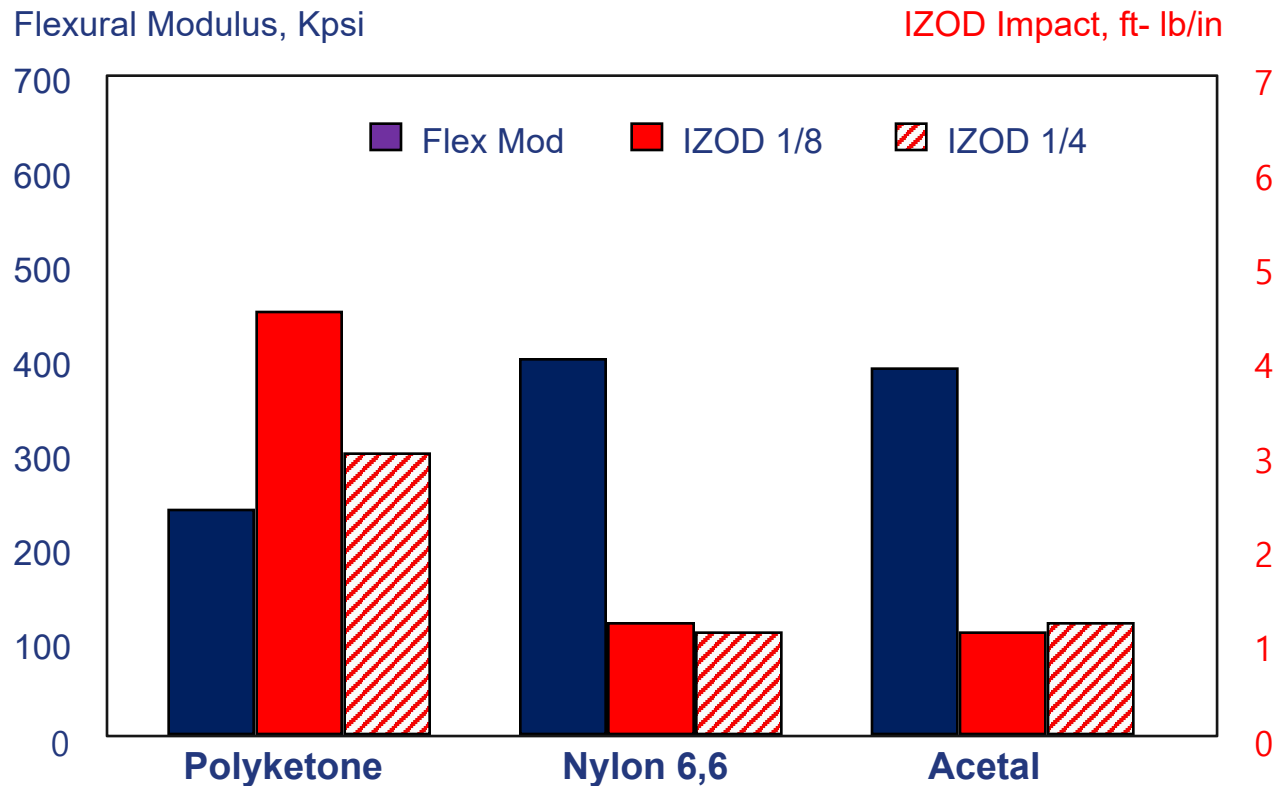
** POK : Hyosung M330A properties.

III.特性和应用-在较宽泛环境温度下，具有优异的抗冲击性能

良好均衡的刚性和韧性

- 聚酮在拥有足够的拉伸强度和弯曲模量的同时，具有非常高的韧性

→ 良好均衡性能的工程塑料



III.特性和应用-在较宽泛环境温度下，具有优异的抗冲击性能

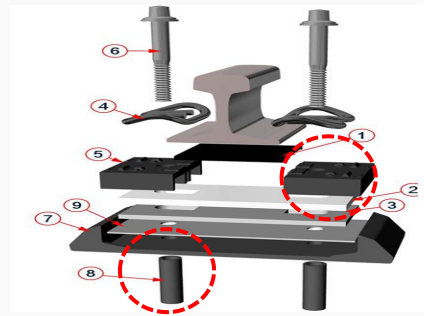
高抗冲性能的应用



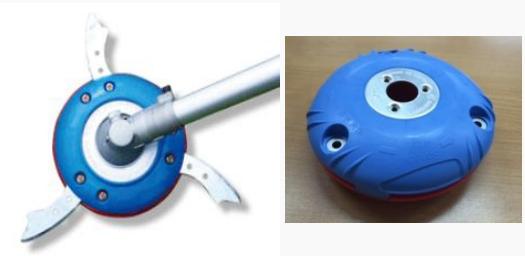
汽车接插件



空调外机电动机转子



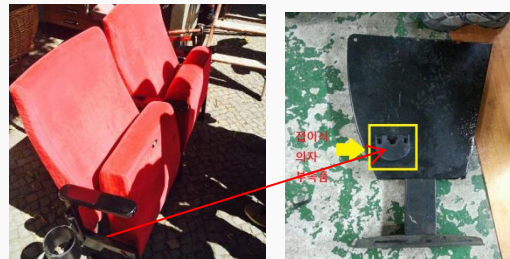
Rail Fastening System



割草机外壳



脚轮



Lawn Chair Bracket



Headset Band

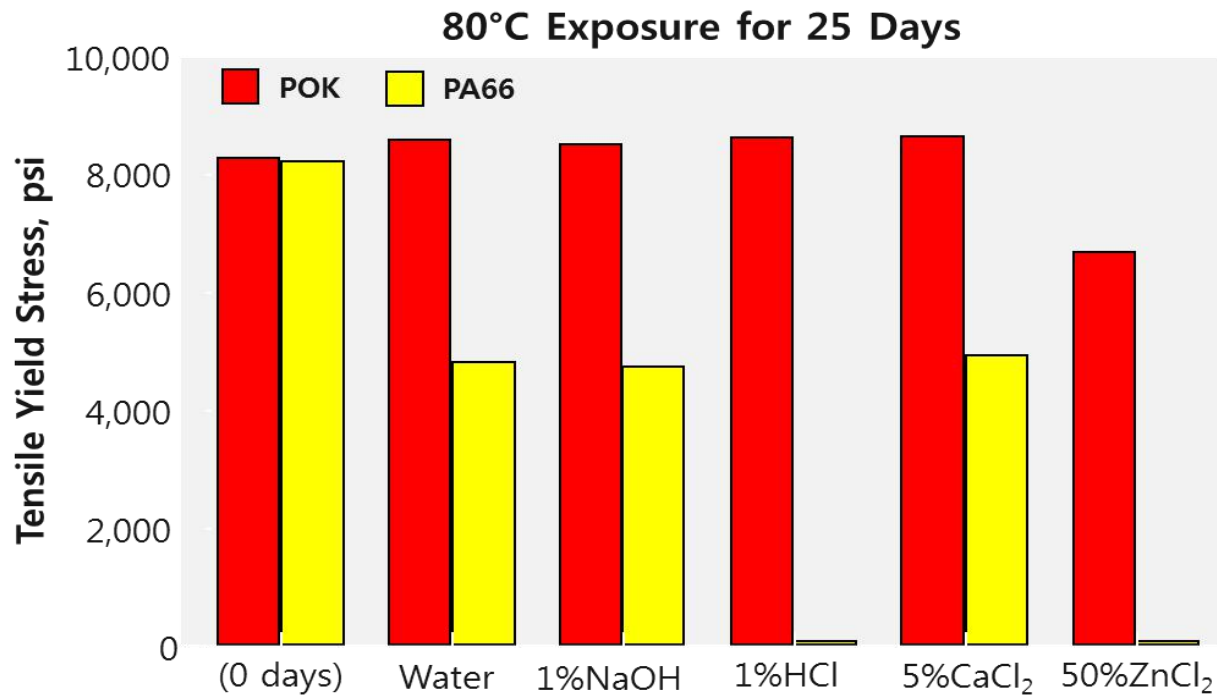
* 正在开发中

III. 特性和应用-出色的耐化学，耐燃油性和耐水解性

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“优异的耐化学性”

- 聚酮是耐化学性最优的塑料之一
- 由于优异的耐化学性，聚酮在酸/碱的环境下性能也不会下降



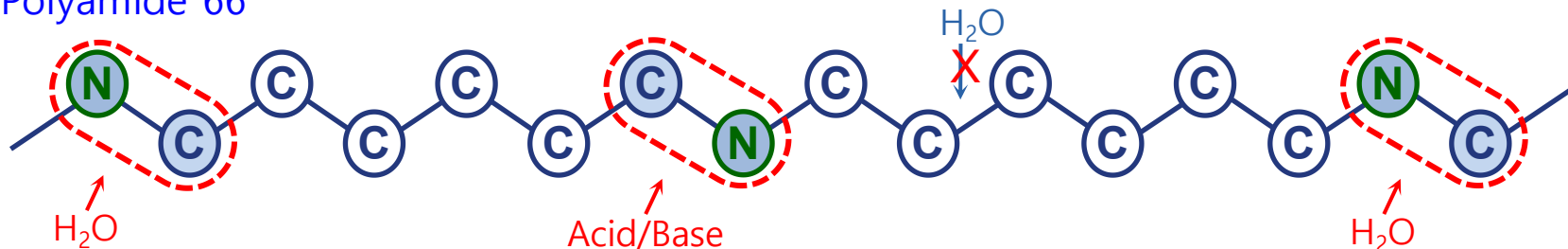
III.特性和应用-出色的耐化学，耐燃油性和耐水解性

从分子结构上看PK耐化学性，耐水解性和低吸湿性原理

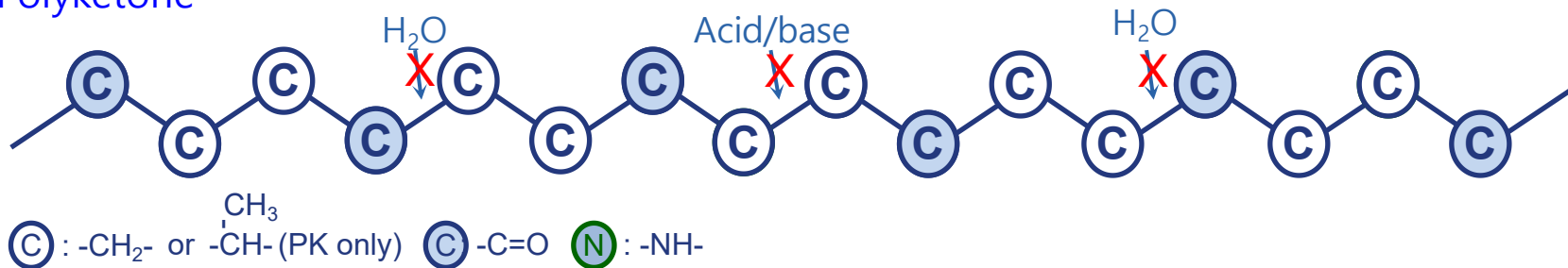
分子结构 (PA66 vs PK)

- **Polyamide 66** : PA主链上的N-C键易于被水分子分解
- **Polyketone** : PK主链上的C=O键对水分子有较高的稳定性
(优异的耐水解性和耐化学性)

Polyamide 66



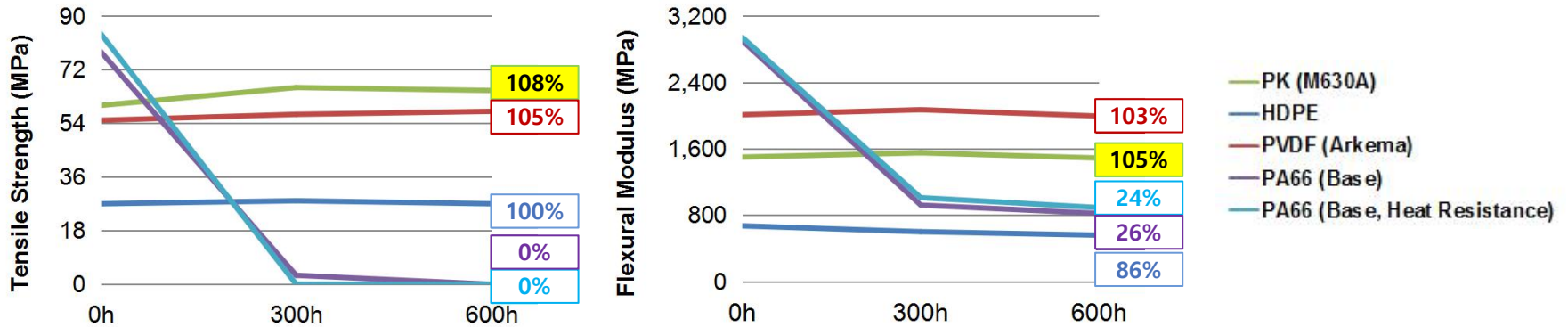
Polyketone



III.特性和应用-出色的耐化学，耐燃油性和耐水解性

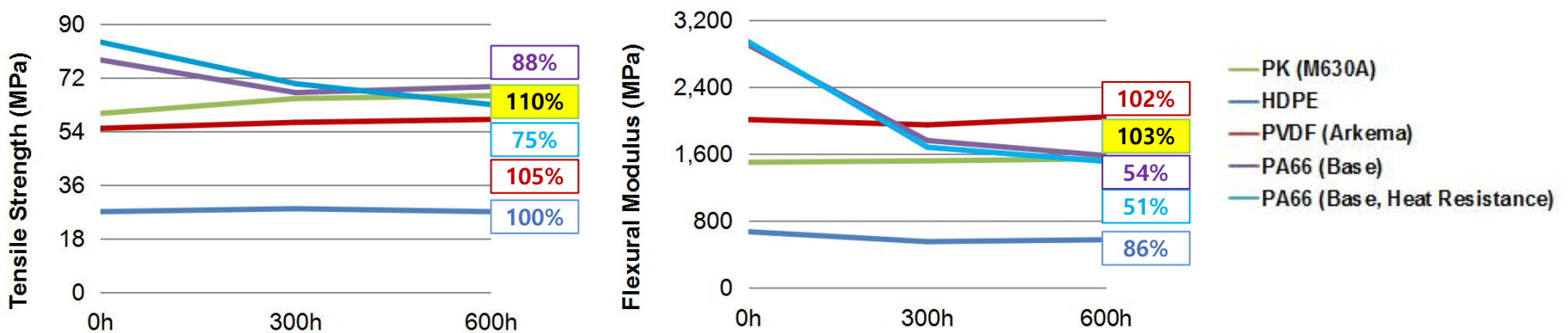
1. Chemical Resistance Test Result with Acid Solution (23°C / 25Days)

HCl 10%, 23°C



2. Chemical Resistance Test Result with Base Solution (23°C / 25Days)

NaOH 10%, 23°C



III.特性和应用-出色的耐化学，耐燃油性和耐水解性

□ 优异的耐化学性

	Semi-crystalline							Amorphous		
	POK	PA66	PA12	POM	PBT	PPS	PVDF	PPO	PSU	PC
碳氢化合物										
脂肪族	+	+	+	+	+	+	+	●	●	●
芳香族	+	+	+	+	+	+	+	●	●	●
卤化物	+	+	●	+	●	+	+	●	●	●
酮类	+	+	+	+	+	+	●	●	●	●
酯类/醚类	+	+	+	+	+	+	+	●	●	●
醛类	+	●	●	+	+	+	+	●	●	●
水性的										
水	+	●	+	+	●	+	+	+	+	+
弱酸	+	●	●	●	●	+	+	+	+	+
弱碱	+	●	●	+	●	+	●	+	●	+
强酸	●	●	●	●	●	●	+	+	●	+
强碱	●	●	●	+	●	●	●	●	●	●

+ 耐抗 ● 不耐抗

备注: 相对的评分包含温度影响

III.特性和应用-出色的耐化学，耐燃油性和耐水解性

耐化学性方面的应用



散热器端槽



洗碗机轴承



液压密封O型圈



Pump Housing



Boiler Heat Exchanger



非金属链条式刮泥机



Salt Field Part



Centralizer

* 正在开发中

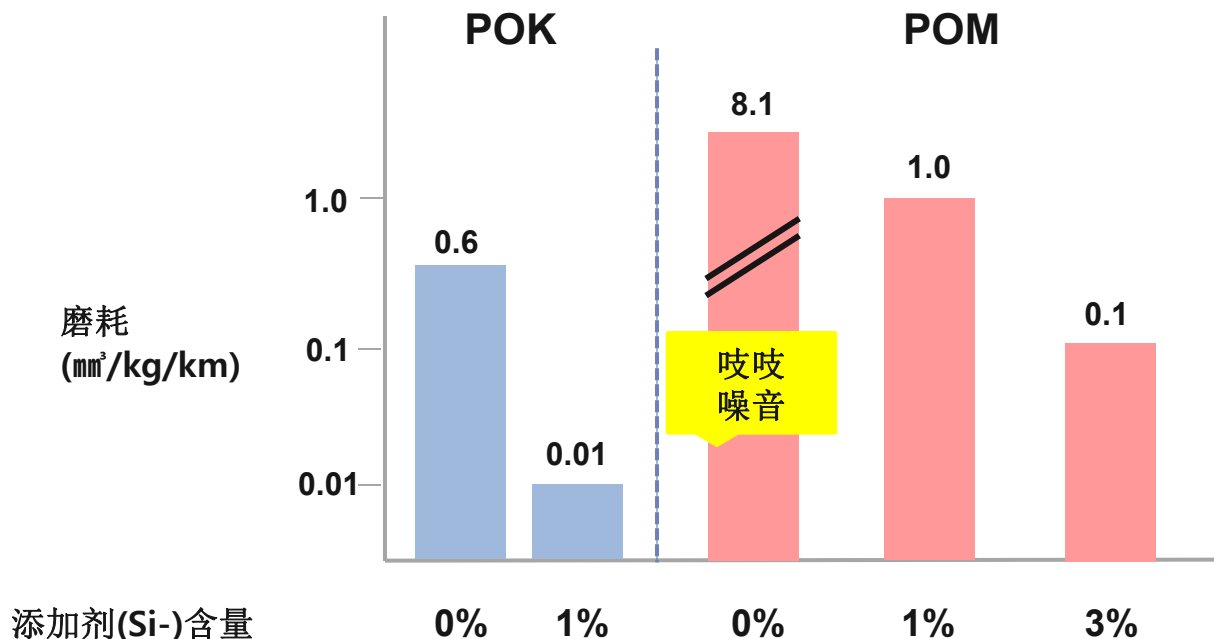
III. 特性和应用-优异的耐磨性

4

特性- 卓越的摩擦性能

聚酮的耐磨性是POM的14倍，是目前最好的材料。它几乎可以永久使用而没有变化。

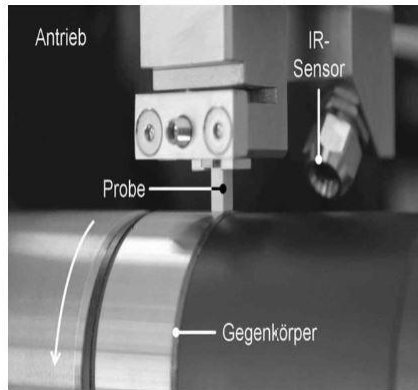
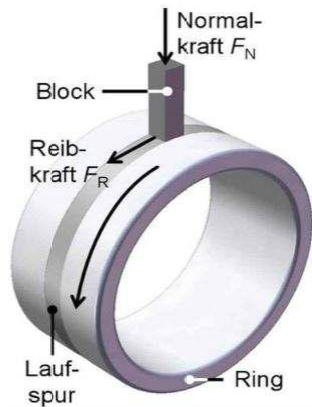
- * POK 基础树脂 > POM 基础树脂 → 14 倍高于
- * POK 基础树脂 > POM + 1%添加剂 → 1.7 倍高于
- * POK + 1%添加剂 > POM + 3%添加剂 → 10 倍高于



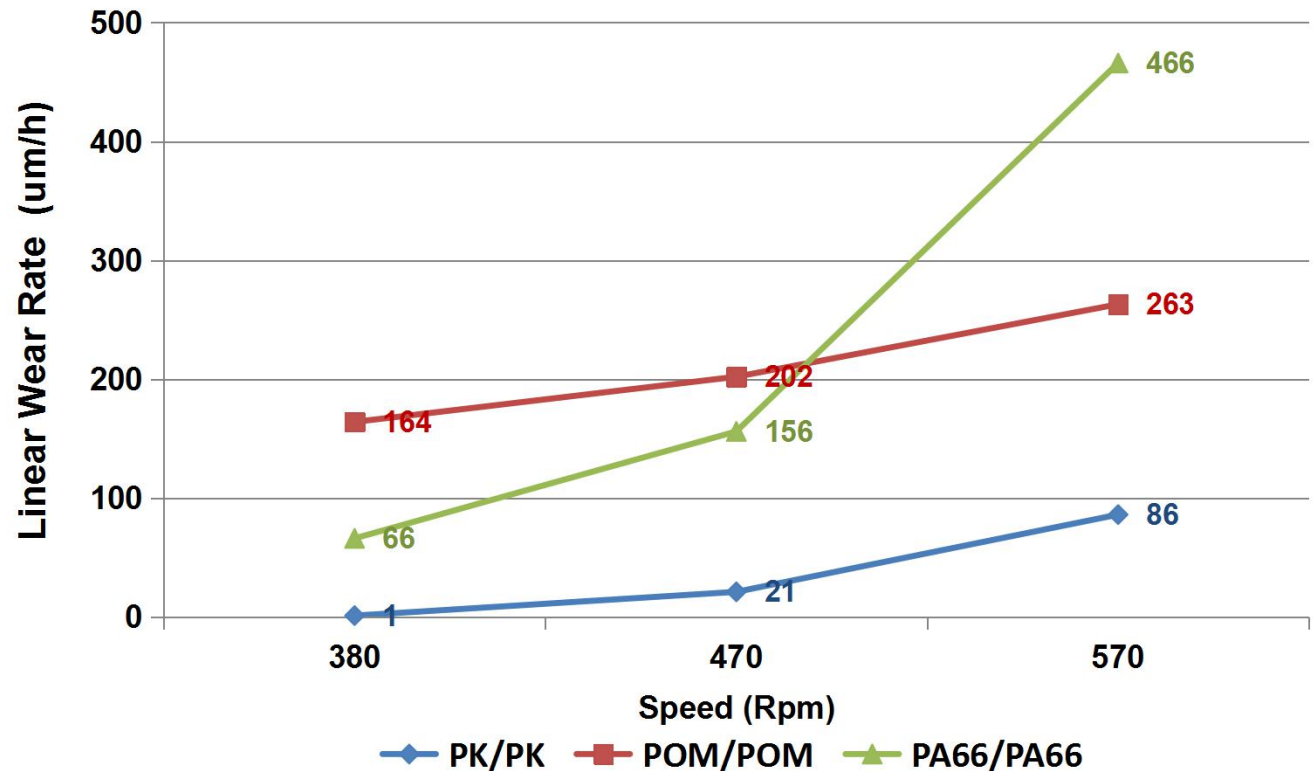
III.特性和应用-优异的耐磨性

Test Method : ASTM G137

- Measure the wear depth (um/h) of the rotated ring specimen with loading a weight
- (Ring : 50mm × 28mm / Diameter × Width), (Block : 6.35mm × 6.00mm × 12.7mm)

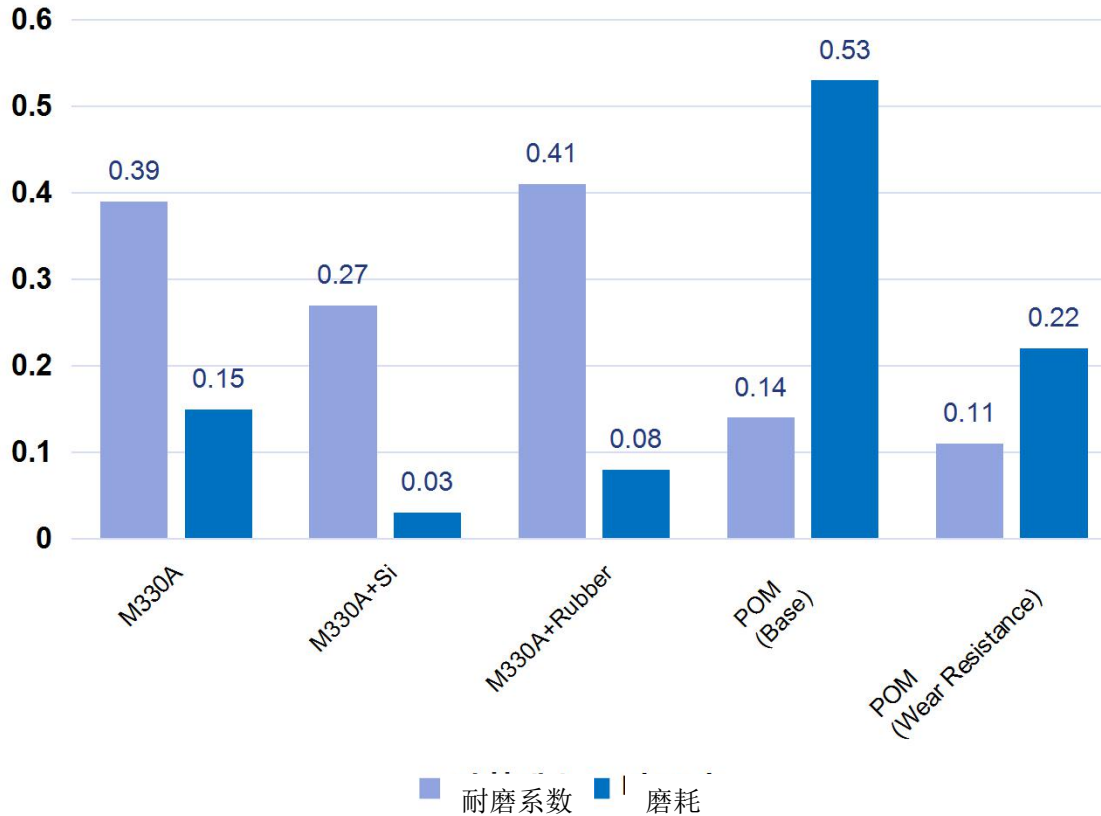


Wear Resistance at 23°C(0.1 MPa, 1h)

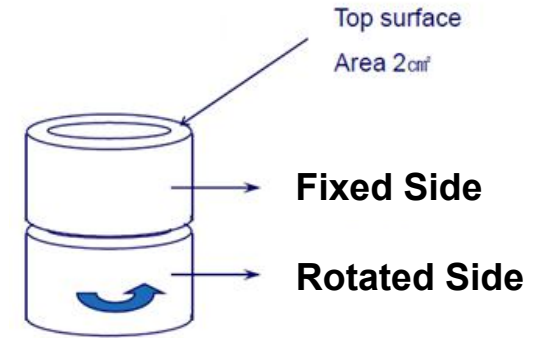


III.特性和应用-优异的耐磨性

Wear Resistance Test Result



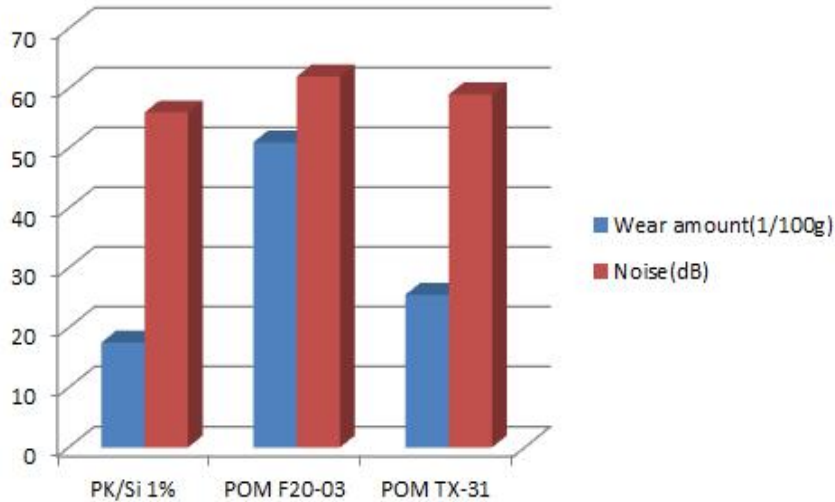
Ring on Ring Test



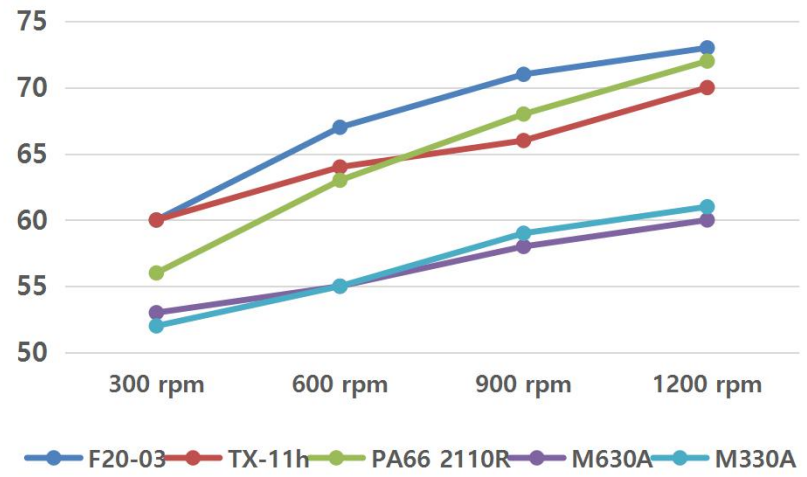
- ▶ Test Standard : JIS K7218
- ▶ vs Same Resin
- ▶ Speed : 50 RPM
- ▶ Load : 150 N
- ▶ Distance : 3.0 km

III.特性和应用-优异的耐磨性

Lower Noise than other Engineering Plastics! (Gear Jig Test Results)

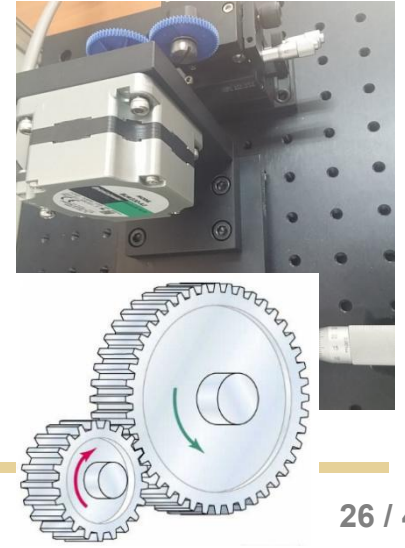


Noise (dB, Gear Distance 1.4mm)



Gear Wear Test Result							
Grade		Condition			Wear amount(10 ⁻³ g)		Noise
Drive Gear	Driven Gear	Speed (RPM)	Time (Day)	Gear distance (μm)	Drive Gear	Driven Gear	dB
PK/Si 1%	PK/Si 1%				600	7	
POM F20-03	POM F20-03	1.6	8.6	62			
POM TX-31	POM TX-31	0.8	4.3	59			

*Gear : Spur gear type, 60 teeth, outer diameter 30mm



III.特性和应用-优异的耐磨性

高耐磨方面的应用



自动取款机和复印机的
齿轮



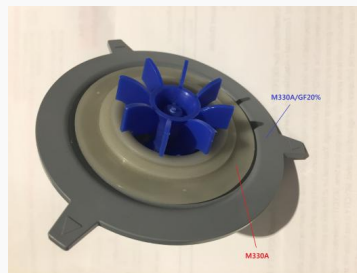
冷藏器的门锁



POS机 零件



座椅凸轮



Dish Drawer Spray Arm Bearing



头顶灯锁扣

* Under Developing with Hyosung's Polyketone.

III. 特性和应用-低透水率和气体阻隔性

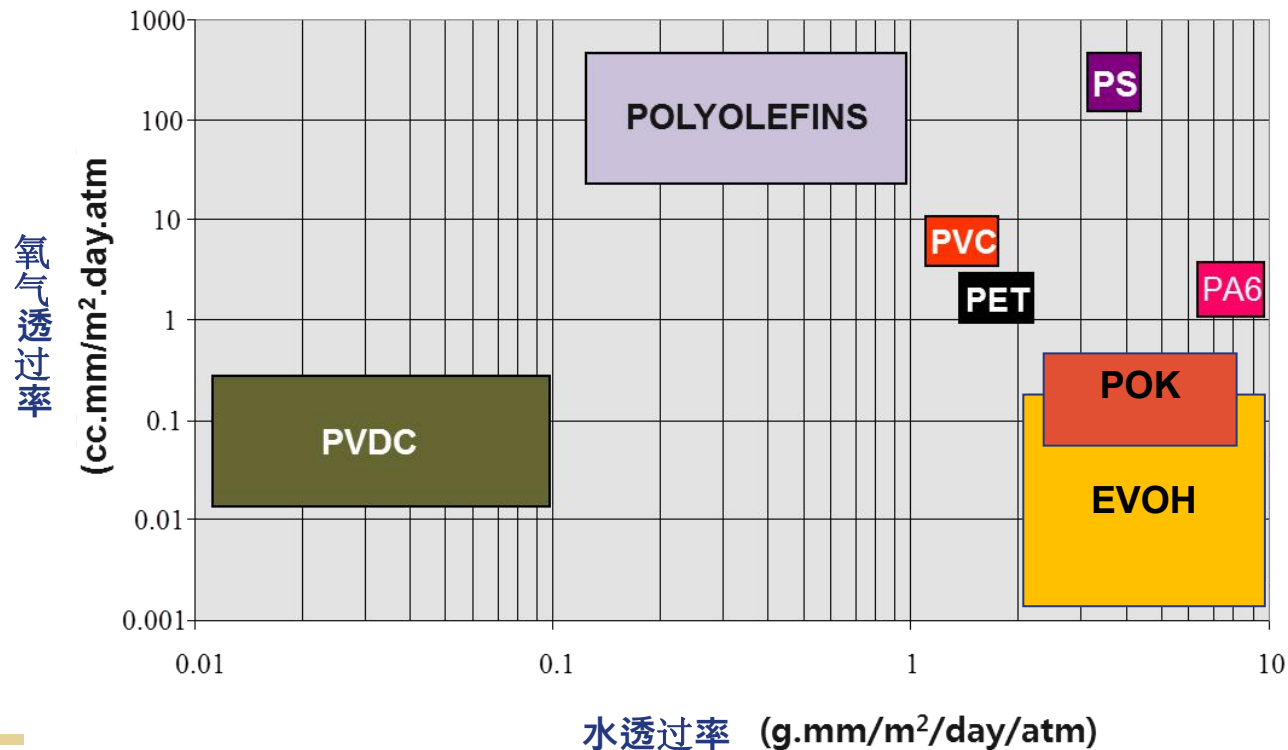
5

高阻隔性：气体阻隔

与EVOH相当，由于具有很好的气体阻隔性能可以用于最高级别的食物包装。

(EVOH：多层，聚酮：单层)

阻隔性能

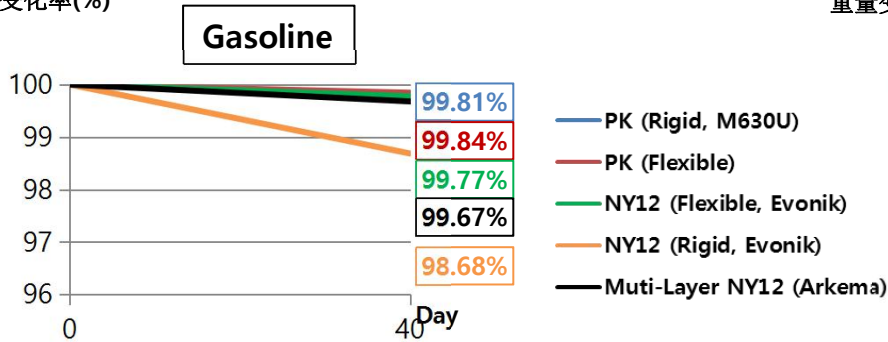


III.特性和应用-低透水率和气体阻隔性

□ 通过了40天(约 1,000小时) 耐燃油性评价, 评价结果比NY12性能优秀：考虑燃油相关用途的应用

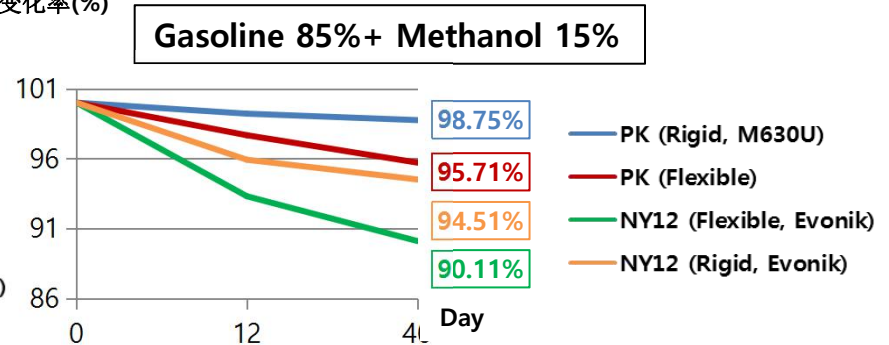
1. 燃料(Gasoline, Gasoline+MeOH)中浸泡后分析重量变化(23°C / 40Days, 燃料管开发时评价的数据)

重量变化率(%)



▪ PK和NY12几乎没有差异

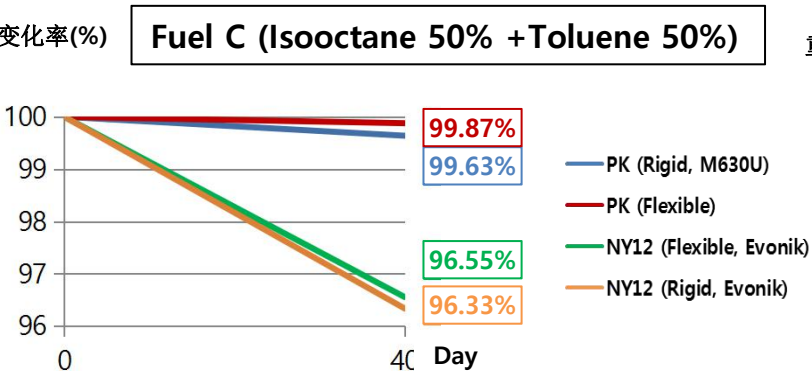
重量变化率(%)



▪ PK比 NY12耐燃油性能优秀 (NY12 有溶出物)

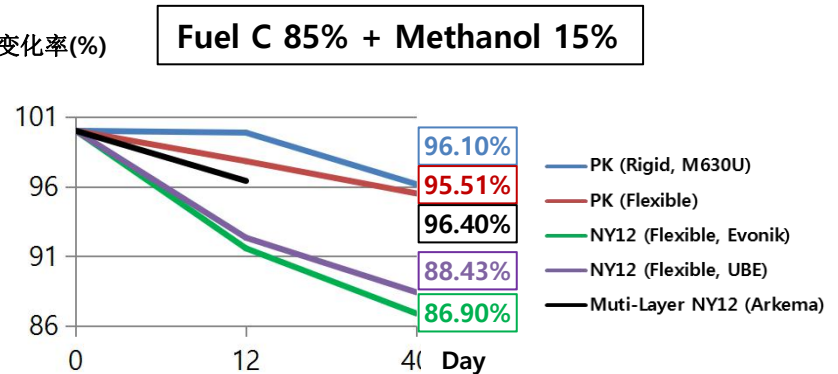
2. 燃料(Fuel C, Fuel C + MeOH)中浸泡后分析重量变化(23°C / 40Days, 燃料管开发时评价的数据)

重量变化率(%)



▪ PK比 NY12耐燃油性能优秀

重量变化率(%)



▪ PK比 NY12耐燃油性能优秀

III.特性和应用-低透水率和气体阻隔性

管件，燃油管，包装方面的应用

特性

- 化学品&烃类的阻隔性能
- 氧气的阻隔性: 食品
- 气味阻隔：
个人护理产品



油气管道



食品包装



包装瓶



个人护理产品

* 正在开发中

- 相关认证
FDA (FCN 1562)

III. 特性和应用

- 绿色环保材料，不含有害物质
 - 水处理应用：管、净水器部件，厨房部件，淋浴头
 - 化妆品：面霜罐肩衬，面霜罐中衬，口红棒防漏，化妆品盖
- 在较宽的应用环境温度下，具有优异的抗冲击性能
 - 汽车：接插件，轮饰盖，车大灯衬套
 - 工业品，电子电器：碱性电池垫圈，电缆密封套，工具外壳，箱体框架
- 出色的耐化学，耐燃油性和耐水解性
 - 汽车：散热器端槽，加油盖，燃油泵外壳
 - 工业品，电子电器：化妆品包装，液压密封，工业支撑件
- 优异的耐磨性
 - 汽车：头顶灯锁扣
 - 工业品，电子电器：自动取款机和复印机齿轮，座椅凸轮，搅拌机底座，工业用切削半成品，窗饰隐形锁扣，冷藏器的门锁
- 低透水率和气体阻隔性
 - 汽车：燃油管，燃油箱
 - 工业品，电子电器：管套，食品包装，包装瓶，个人护理产品

I. 晓星介绍

II. 聚酮是什么

III. 特性和应用

VI. 现在和未来

VI. 现在和未来

Development History 发展历史

- **2004 Start Lab. Scale Development.**
成立实验室，发展放大生产装置
- **2006 Bench scale Polymerization Equipment set-up**
建立实验室规模的聚合反应装置
(产能: 10 MT/Y, Anyang R&DB Labs)
- **2008 Start ENPLA development.**
开始开发工程塑料级聚酮
- **2011 Start Fiber Development.**
开始开发纤维级聚酮
- **2012 Pilot Polymerization Plant set-up.**
建立试验聚合反应车间
(产能 : 1,000 MT/Y, Ulsan Plant)
- **2013 Finish engineering for Commercial Plant.**
完成生产厂的工程
- **2015 Commercial Plant start .**
生产厂开始运行
(产能: 50,000 MT/Y, Ulsan Plant)

晓星的基本材料技术开发和工程设计已经完成
“2015年5月生产厂开始运行”

- **专利 : 共160(国家专利133, 世界专利27)**

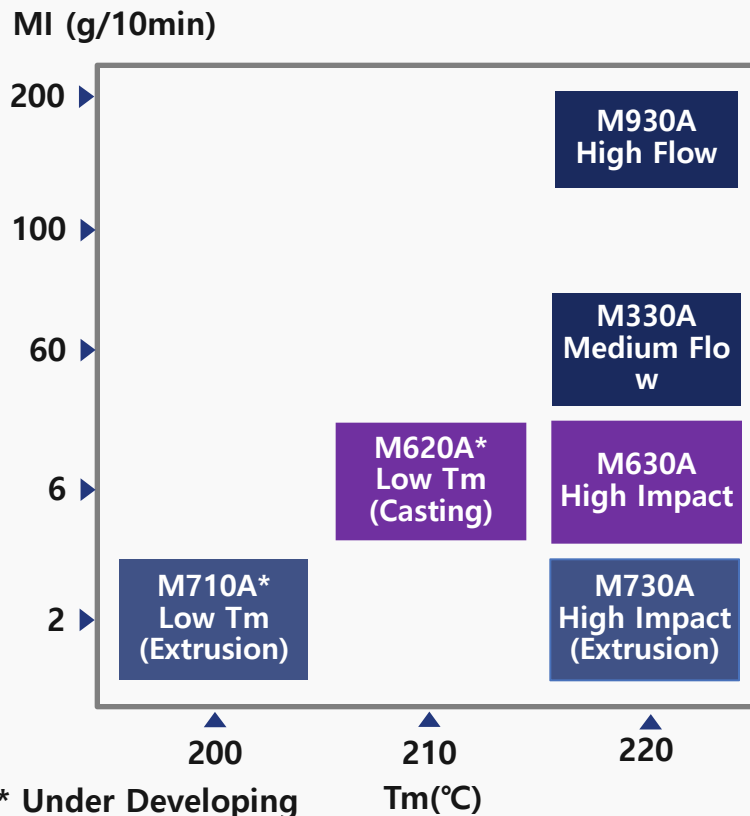
□ **商业化装置: 50,000 MT/Y**



V. 商业化型号和特性

Portfolio

- 6 个基础规格 and 57 改性规格
- 熔融指数 3~200，熔点200~220°C，可以注塑和挤出



PK Grade		Characteristic	
M930A	高流动	注塑	高填充
M330A	中等流动		通用/薄壁注塑件
M620A	高抗冲	挤出/注塑	基础管/高柔性膜挤出 高抗冲注塑产品
M630A			基础管 高抗冲注塑产品
M710A	高抗冲 低熔点	挤出	基础管,高柔性膜挤出
M730A	高抗冲		基础管

V. 商业化型号和特性

注塑级 基础树脂规格：高流动性 M930A, 中等流动性 M330A, 高抗冲击性 M630A.

Item 项目	Method 方法	Unit 单位	M930A	M330A	M630A
Physical 物性					
Density 密度	ASTM D792	g/cm ³	1.24	1.24	1.24
Water Content 吸水率 (23°C, 50% RH, Eq.)	ASTM D570	%	0.13	0.13	0.13
Thermal 热性能					
Melting Temperature 熔点	ASTM D1525	°C	220	220	220
Melt Flow Rate 融指 (240°C, 2.16kg)	ASTM D1238	g/10min	165	60	6
Deflection Temperature 变形温度 : HDT 0.45MPa(4.6 kg/cm ²)	ASTM D648	°C	205	210	210
Mechanical 机械性能					
Tensile Strength 抗张强度	ASTM D638	MPa	62	60	58
Nominal Strain at Break 断裂伸长率	ASTM D638	%	130	300	300
Flexural Strength 弯曲强度	ASTM D790	MPa	60	58	50
Flexural Modulus 弯曲模量	ASTM D790	MPa	1,600	1,550	1,300
Charpy Notched Impact Strength 缺口冲击强度	ASTM D256	kJ/m ²	6	9	18
Electrical 电气特性					
Volume Resistivity 体积电阻率	ASTM D257	Ω·cm	10 ¹⁵	10 ¹⁵	10 ¹⁵
Dielectric Strength 介电强度	ASTM D149	KV/mm	20	17	17


V. 商业化型号和特性

挤出级 基础树脂

Item 项目	Method 方法	Unit 单位	M620A	M710A	M730A
Physical 物性					
Density 密度	ASTM D792	g/cm ³	1.24	1.24	1.24
Water Content 吸水率 (23°C, 50% RH, Eq.)	ASTM D570	%	0.13	0.13	0.13
Thermal 热性能					
Melting Temperature 熔点	ASTM D1525	°C	210	200	220
Melt Flow Rate 融指 (240°C, 2.16kg)	ASTM D1238	g/10min	6	3	3
Mechanical 机械性能					
Tensile Strength 抗张强度	ASTM D638	MPa	50	48	58
Nominal Strain at Break 断裂伸长率	ASTM D638	%	300	250	300
Flexural Strength 弯曲强度	ASTM D790	MPa	47	44	48
Flexural Modulus 弯曲模量	ASTM D790	MPa	1,100	1,000	1,200
Charpy Notched Impact Strength 缺口冲击强度	ASTM D256	kJ/m ²	14	17	19
Electrical 电气特性					
Volume Resistivity 体积电阻率	ASTM D257	Ω·cm	10 ¹⁵	10 ¹⁵	10 ¹⁵
Dielectric Strength 介电强度	ASTM D149	KV/mm	17	17	17

VI. 现在和未来

▶ 认证 ISO 9001 / ISO 14001


bsi.  By Royal Charter

Certificate of Registration


QUALITY MANAGEMENT SYSTEM - ISO 9001:2008

This is to certify that: **Hyosung Co., Ltd.**
Yongyeon Plant-POK Biz. Division
65, Cheoyong-ro 487 beon-gil
Nam-gu
Ulsan
44784
Republic of Korea

Holds Certificate No: **FM 638786**
and operates a Quality Management System which complies with the requirements of ISO 9001:2008 for the following scope:
The development, design and manufacture of polyketon.

For and on behalf of BSI: 
Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 27/08/2015
Latest Revision Date: 27/08/2015
Effective Date: 27/08/2015
Expiry Date: 26/08/2018
Page: 1 of 2



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bsi.  By Royal Charter

Certificate of Registration


ENVIRONMENTAL MANAGEMENT SYSTEM - ISO 14001:2004

This is to certify that: **Hyosung Co., Ltd.**
Yongyeon Plant-POK Biz. Division
65, Cheoyong-ro 487 beon-gil
Nam-gu
Ulsan
44784
Republic of Korea

Holds Certificate No: **EMS 638787**
and operates an Environmental Management System which complies with the requirements of ISO 14001:2004 for the following scope:
The manufacture of polyketon.

For and on behalf of BSI: 
Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 27/08/2015
Latest Revision Date: 27/08/2015
Effective Date: 27/08/2015
Expiry Date: 26/08/2018
Page: 1 of 2



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VI. 现在和未来

▶ 认证- FDA FCN 1562



DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Food and Drug Administration
College Park, MD 20740-3835

September 18, 2015

Richard C. Kraska
GRAS Associates, LLC
27499 Riverview Center Parkway, Suite 212.
Bonita Springs, FL 341 34

RE: Food Contact Substance Notification (FCN) 001562
Acknowledgement Letter

Dear Dr. Kraska:

This letter acknowledges receipt of your notification, FCN 001562, on June 1, 2015, with substantive amendments received August 7, 10, 11, 24, 25, and September 11, 2015, submitted on behalf of Hyosung Corporation. The description FDA will be considering in its review of this FCN is below:

Food Contact Substance (FCS)

Carbon monoxide - ethylene -propylene terpolymer (CAS Reg. No. 88995-51-1)

Notifier

Hyosung Corporation

Manufacturer/Supplier

Hyosung Corporation

Intended Use

For use in articles intended for repeated-use in food processing establishments, for multilayer flexible packaging for refrigerated food products, and for reheatable or microwavable rigid retort packaging for food, except for use in contact with infant formula and breast milk (see Limitations/Specifications).

Limitations/ Specifications

For use in contact with all foods, except beverages containing more than 8 volume percent alcohol, under Conditions of Use A - H, as described in Table 2 (see Attachment 1.) The maximum thickness of the FCS is 10 mil. The FCS is not for use in contact with infant formula and breast milk. Such uses were not included as part of the intended use of the substance in the FCN.

If we do not object to your notification prior to January 9, 2016, the notification will become effective on that date. If your notification becomes effective, it will be added to the list of effective notifications available on the agency's internet site and your environmental record will be made publically available in the Food Ingredients and Packaging section under the Food topic on the Agency's internet site at <http://www.fda.gov>.

The above description will be used by FDA to describe your notification should it become effective. Accordingly, please review the description for technical accuracy, review the environmental assessment for confidential information, and provide us with any comments within 30 days from the date of this letter. If your comments result in changes to the identity or intended use of the substance, FDA will

Attachment 1

Definitions of Food Types and Conditions of Use for Food Contact Substances

These tables were created for easy reference for notifications relating to a food contact substance.

Table 1--Types of Raw and Processed Foods

- I. Nonacid, aqueous products; may contain salt or sugar or both (pH above 5.0).
- II. Acid, aqueous products; may contain salt or sugar or both, and including oil-in-water emulsions of low- or high-fat content.
- III. Aqueous, acid or nonacid products containing free oil or fat; may contain salt, and including water-in-oil emulsions of low- or high-fat content.
- IV. Dairy products and modifications:
 - A. Water-in-oil emulsions, high- or low-fat
 - B. Oil-in-water emulsions, high- or low-fat.
- V. Low-moisture fats and oil.
- VI. Beverages:
 - A. Containing up to 8 percent of alcohol.
 - B. Nonalcoholic.
 - C. Containing more than 8 percent alcohol.
- VII. Bakery products other than those included under Types VIII or IX of this table:
 - A. Moist bakery products with surface containing free fat or oil.
 - B. Moist bakery products with surface containing no free fat or oil
- VIII. Dry solids with the surface containing no free fat or oil (no end test required).
- IX. Dry solids with the surface containing free fat or oil.

Table 2--Condition of use

- A. High temperature heat-sterilized (e.g., over 212 deg. F).
- B. Boiling water sterilized.
- C. Hot filled or pasteurized above 150 deg. F.
- D. Hot filled or pasteurized below 150 deg. F.
- E. Room temperature filled and stored (no thermal treatment in the container).
- F. Refrigerated storage (no thermal treatment in the container).
- G. Frozen storage (no thermal treatment in the container).
- H. Frozen or refrigerated storage: Ready-prepared foods intended to be reheated in container at time of use:
 1. Aqueous or oil-in-water emulsion of high- or low-fat.
 2. Aqueous, high- or low-free oil or fat.
- I. Irradiation
- J. Cooking at temperatures exceeding 250 deg. F

VI. 现在和未来

► 认证- NSF/ANSI 61

NSF International

789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Hyosung Corporation

Facility: Ulsan, Republic of Korea

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.



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PRODUCT CERTIFICATION
61/219
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Accredited by the
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Standards Council of Canada
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Standards Council
of Canada

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February 6, 2015
Certificate# C0219119 - 01

A handwritten signature in black ink, appearing to read "David Purkiss".

David Purkiss
General Manager, Water Systems

VI. 现在和未来

► 认证- EU Directive 10-2011

++++
ENVIGO

Certificate of Compliance

for

**Hyosung Polyketones:
M230A, M330A, M630A, M730A
and M620A**

Products of

**HYOSUNG CORPORATION
Seoul / Korea**

++++

Issued by

Envigo
Regulatory Consulting
4452 Itingen
Switzerland
Phone+41 (0)61 975 11 11
Fax +41 (0)61 975 52 84

Regulatory Consulting

++++
ENVIGO

CERTIFICATE

of compliance with the
European Commission Regulation (EU) No 10/2011 and its amendments

for

**Hyosung Polyketone:
M230A, M330A, M630A, M730A, M620A**

The detailed compositions of the above mentioned materials have been disclosed by Hyosung Corporation, 235, Banpo-Daero, Seocho-Gu, Seoul, 137-804, Korea to Envigo, Regulatory Consulting, Itingen / Switzerland on October 25th, 2015. Based on the evaluation of this information for compositional compliances we herewith can confirm that the above mentioned plastic materials are in compliance with the European Commission Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food, including its last amendment Commission Regulation (EU) No 174/2015.

Limitations:

The final articles coming into contact with foodstuffs must comply with the general provisions for food contact materials and must not endanger human health or bring about an unacceptable change in the composition of the food or bring about a deterioration in the organoleptic characteristics thereof.

It must also comply with the overall migration limit of 10 mg/kg contact surface or 80 mg/kg food and with the specific migration limit of 6 mg/kg food for Methacrylic Acid (CAS No 79-41-4)

The specific migration of the dust use additive Calcium Phosphate (CAS No 7758-87-4, E 341) from the final article coming into contact with foodstuffs has to be considered with respect to the limits set in the food legislation.

This certificate is based on the information provided to Envigo, Regulatory Consulting and on the present legislation as mentioned above. The validity expires in case of any relevant modification of the formulation or any change of the legislation.



Dr. W. Nief
Expert Consultant,
Food Contact Materials



Dr. S. Niven
Business Lead Consultant,
Chemicals

Itingen, November 17th, 2015
Expiration date: November 17th, 2018
Envigo Project E00009b / NEW

Envigo, Regulatory Consulting, • Zeltweg 1 • 4452 Itingen Switzerland • Phone +41 61 975 11 11 • Fax +41 61 975 52 84 • www.envigo.com 1/1

VI. 现在和未来

► 认证- EU Directive 10-2011

++++
ENVIGO

Certificate of Compliance

for

**Hyosung Polyketones:
M230F, M330F, M630F, M730F
and M620F**

Products of

**HYOSUNG CORPORATION
Seoul / Korea**

++++

Issued by

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Regulatory Consulting

++++
ENVIGO

CERTIFICATE

of compliance with the
European Commission Regulation (EU) No 10/2011 and its amendments

for

**Hyosung Polyketone:
M230F, M330F, M630F, M730F, M620F**

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Limitations:

The final articles coming into contact with foodstuffs must comply with the general provisions for food contact materials and must not endanger human health or bring about an unacceptable change in the composition of the food or bring about a deterioration in the organoleptic characteristics thereof.
It must also comply with the overall migration limit of 10 mg/dm² contact surface or 60 mg/kg food and with the specific migration limit of 6 mg/kg food for Methacrylic Acid (CAS No 79-41-4).
The specific migration of the dual use additive Calcium Phosphate (CAS No 7758-87-4, E 341) from the final article coming into contact with foodstuffs has to be considered with respect to the limits set in the food legislation.
This certificate is based on the information provided to Envigo, Regulatory Consulting and on the present legislation as mentioned above. The validity expires in case of any relevant modification of the formulation or any change of the legislation.



Dr. W. Nef
Expert Consultant,
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Dr. S. Niven
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Chemicals

Itingen, November 17th, 2015
Expiration date: November 16th, 2018
Envigo Project: E00905a / NEW

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3/1

VI. 现在和未来

▶ 认证 UL 94 & 746A (非阻燃, 基础树脂 & 玻纤增强规格)

iq.ul.com

Component - Plastics [guide info]

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M330A

Polyketone, furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	0.8	HB	4	0	50	50	50
	1.5	HB	3	0	50	50	50
	3.0	HB	2	0	50	50	50

Comparative Tracking Index (CTI): 0

Dielectric Strength (kV/mm): 23

High-Voltage Arc Tracking Rate (HVTR): 0

Dimensional Stability (%): -

Inclined Plane Tracking (IPT): -

Volume Resistivity (10⁸ ohm-cm): 12

High Volt. Low Current Arc Resis (D495): 4

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2012-04-10

Last Revised: 2012-04-23

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60895-11-10	Class (color)	0.8	HB75 (ALL)
			1.5	HB75 (ALL)
			3.0	HB40 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60895-2-12	C	0.8	700
			1.5	700
			3.0	700
Glow-Wire Ignition (GWIT)	IEC 60895-2-13	C	0.8	725
			1.5	725
			3.0	725
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60895-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

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Component - Plastics [guide info]

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M33(c)AG6BA

Polyketone, furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	0.8	HB	4	0	50	50	50
	1.6	HB	2	0	50	50	50
	3.2	HB	0	0	50	50	50

Comparative Tracking Index (CTI): 0

Dielectric Strength (kV/mm): -

High-Voltage Arc Tracking Rate (HVTR): 1

Dimensional Stability (%): -

(c) - Represents 1 digit numeric 0-9 which varies based on colors.

Inclined Plane Tracking (IPT): -

Volume Resistivity (10⁸ ohm-cm): -

High Volt. Low Current Arc Resis (D495): -

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2015-11-25

Last Revised: 2015-11-24

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60895-11-10	Class (color)	0.8	HB75 (ALL)
			1.6	HB75 (ALL)
			3.2	HB40 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60895-2-12	C	-	-
Glow-Wire Ignition (GWIT)	IEC 60895-2-13	C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60895-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

VI. 现在和未来

▶ 认证 UL 94 & 746A (非填充, 卤素 & 无卤阻燃规格)

iq.ul.com

Component - Plastics [guide info]

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M33(c)AF2JH

Polyketone

Color	Min Thk (mm)	Flame Class	HWI		RTI		RTI Str
			HAI	Eleo	Imp	Eleo	
NC	0.8	V-0	0	0	50	50	50
NC, RD, BK	1.5	V-0	0	0	50	50	50
	2.0	V-0	0	0	50	50	50
ALL	3.0	V-0	0	0	50	50	50

Comparative Tracking Index (CTI): 0

Dielectric Strength (kV/mm): 13

High-Voltage Arc Tracking Rate (HVTR): 2

Dimensional Stability (%): -

Inclined Plane Tracking (IPT): -

Volume Resistivity (10⁹ ohm-cm): 12

High Volt. Low Current Arc Resis (D495): 5

(c) - Represents 1 digit numeric 0-9 which varies based on colors.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2013-07-19

Last Revised: 2015-11-24

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	0.8	V-0 (NC)
			1.5	V-0 (NC, RD, BK)
			2.0	V-0 (NC, RD, BK)
			3.0	V-0 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	C	2.0	980
			3.0	960
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	C	2.0	800
			3.0	800
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

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Component - Plastics [guide info]

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M33(c)AF2JA

Polyketone, furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI		RTI		RTI Str
			HAI	Eleo	Imp	Eleo	
ALL	0.8	V-0	3	0	50	50	50
	1.5	V-0	0	0	50	50	50
	2.0	V-0	-	-	50	50	50
	3.0	V-0	0	0	50	50	50

Comparative Tracking Index (CTI): 0

Dielectric Strength (kV/mm): 16.23

High-Voltage Arc Tracking Rate (HVTR): 2

Dimensional Stability (%): -

Inclined Plane Tracking (IPT): -

Volume Resistivity (10⁹ ohm-cm): 11

High Volt. Low Current Arc Resis (D495): 6

(c) - Represents 1 digit numeric 0-9 which varies based on colors.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2014-04-04

Last Revised: 2015-11-24

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	0.8	V-0 (ALL)
			1.5	V-0 (ALL)
			2.0	V-0 (ALL)
			3.0	V-0 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	C	2.0	960
			3.0	960
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	C	2.0	725
			3.0	725
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

VI. 现在和未来

▶ 认证 UL 94 & 746A (玻纤增强, 卤素& 无卤阻燃规格)

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Component - Plastics [\[guide info\]](#)

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M33(c)AG(d)BP

Polyketone, furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	0.8	V-0	0	0	50	50	50
	1.5	V-0	0	0	50	50	50
	2.0	V-0	-	-	50	50	50
	3.0	V-0	0	0	50	50	50

Comparative Tracking Index (CTI): 2

Dielectric Strength (kV/mm): 15

High-Voltage Arc Tracking Rate (HVTR): 3

Dimensional Stability (%): -

(c) - Represents 1 digit numeric 0-9 which varies based on colors.

(d) - Represents 1 digit numeric 1-9 which varies based on glass fiber contents.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2014-08-18

Last Revised: 2015-11-24

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	0.8	V-0 (ALL)
			1.5	V-0 (ALL)
			2.0	V-0 (ALL)
			3.0	V-0 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	C	2.0	960
			3.0	960
			2.0	750
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	C	3.0	775
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

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Component - Plastics [\[guide info\]](#)

E163907

HYOSUNG CORP

450 KONGDUK-DONG, MAPO-KU, SEOUL 121-720 KR

M33(c)AG(d)BH

Polyketone

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
NC, BK	0.8	V-0	0	0	50	50	50
ALL	1.5	V-0	0	0	50	50	50
	2.0	V-0	0	0	50	50	50
	3.0	V-0	0	0	50	50	50

Comparative Tracking Index (CTI): 2

Dielectric Strength (kV/mm): 17

High-Voltage Arc Tracking Rate (HVTR): 2

Dimensional Stability (%): -

(c) - Represents 1 digit numeric 0-9 which varies based on colors.

(d) - Represents 1 digit numeric 1-9 which varies based on glass fiber contents.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2013-07-31

Last Revised: 2015-11-24

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	0.8	V-0 (NC, BK)
			1.5	V-0 (ALL)
			2.0	V-0 (ALL)
			3.0	V-0 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	C	2.0	960
			3.0	960
			2.0	800
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	C	3.0	800
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-2	kJ/m ²	-	-

VI. 现在和未来

▶ 认证: 不含甲醛

MSZ-009-2002-0014

시험성적서

1. 성적서 번호 : CT14-083721
2. 의뢰자
 - 업체명 : (주)효성안양공장
 - 주소 : 경기도 안양시 동안구 시민대로 74 (호계동) 효성기술원 ENPLA팀
 - 의뢰일자 : 2014.08.07
 - 시험발급일 : 2014.08.14
3. 시험성적서의 용도 : 거래처 제출
4. 시료명 : POLYKETONE PELLET
5. 시험방법
 - (1) MS 900-55:2014

확인	작성자 성명	홍승표	기술책임자 성명	유경환
비고 : 1. 이 성적서는 의뢰자가 제시한 시료 및 시료명으로 시험한 결과로서 정확 정확에 대한 책임을 보증하지는 않습니다. 2. 이 성적서는 홍보, 안전, 광고 및 소송용으로 사용할 수 없으며, 용도 이외의 사용을 금합니다.				

한국건설생활환경시험연구원



군포시험실 : 435-010 경기도 군포시 광안로 149 1F VALLEY군포 805호 (031)389-9100
 결과문의 : 안전환경센터 ☎ (031)389-9106

측정기기 용 1페이지

양식QP-20-01-06(2)

시험성적서

성적서번호 : CT14-083721

시험결과

시험항목	단위	시험결과	검출한계	최소요구기준 (적용)	시험방법
Benzene	µg/m ³	ND	10	30	MS 900-55 : 2014 (중량분석법)
Toluene	µg/m ³	Tr	10	1 000	
Ethylbenzene	µg/m ³	Tr	10	1 000	
m,p-Xylene	µg/m ³	Tr	10	970	
o-Xylene	µg/m ³	Tr			
Styrene	µg/m ³	ND	10	220	
Formaldehyde	µg/m ³	ND	15	210	
Acetaldehyde	µg/m ³	Tr	10	50	
Acrolein	µg/m ³	ND	10	50	

※ ND : Not Detected

※ Tr : Trace

측정기기 용 2 페이지

양식QP-20-01-06(2)

VI. 现在和未来

▶ 认证：不含双酚和邻苯二甲酸酯



Test Report No. F690101/LF-CTSAYAA14-60015

Issued Date : 2015. 01. 08

Page 1 of 4

HYOSUNG CORPORATION
163-2 Higyae-dong, Dongan-gu
Anyang-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYAA14-60015
Product Name : M330A
Item No./Part No. : N/A
Received Date : 2014. 12. 31
Test Period : 2015. 01. 01 to 2015. 01. 08
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

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Test Report No. F690101/LF-CTSAYAA14-60015

Issued Date : 2015. 01. 08

Page 2 of 4

Sample No. : AYAA14-60015.D01
Sample Description : M330A
Item No./Part No. : N/A
Materials : POLYKETONE

Phthalates

Test Items	Unit	Test Method	MDL	Results
Di-methyl phthalate (DMP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-ethyl phthalate (DEP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-propyl phthalate (DPP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-isobutyl phthalate (DIBP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-butyl phthalate (DBP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-pentyl phthalate (DPP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-n-hexyl phthalate (DNHP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Benzyl butyl phthalate (BBP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di(2-ethylhexyl) adipate (DEHA)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Dicyclohexyl phthalate (DCHP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di(2-ethylhexyl) phthalate (DEHP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-n-octyl phthalate (DNOP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-isononyl phthalate (DINP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-isodecyl phthalate (DIDP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-nonyl phthalate (DNP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Bis(2-methoxyethyl) phthalate (BMP, DMEP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
[di(C7-C11 alkyl)phthalate] linear-branch (DIHP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
Di-isooctyl phthalate (DIOP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.
[di(C6-C8 alkyl)phthalate] branched (DHNBP)	mg/kg	With reference to EPA 8061A, GC/MS	50	N.D.

Other(s)

Test Items	Unit	Test Method	MDL	Results
Bisphenol A	mg/kg	In-House, HPLC/DAD	10	N.D.

NOTE: (1) N.D. = Not detected (<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

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VI. 现在和未来

▶ 认证: 不含卤素

SGS

Test Report No. F690101/LF-CTSAYAA15-41888 Issued Date : 2015. 08. 18 Page 1 of 3

HYOSUNG CORPORATION
183-2 Hoggye 2-dong, Dongan-gu
Anyang-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYAA15-41888
Product Name : M33DA
Item No./Part No. : N/A
Received Date : 2015. 08. 12
Test Period : 2015. 08. 12 to 2015. 08. 18
Test Results : For further details, please refer to following page(s)

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Test Report No. F690101/LF-CTSAYAA15-41888 Issued Date : 2015. 08. 18 Page 2 of 3

Sample No. : AYAA15-41888.001
Sample Description : M33DA
Item No./Part No. : N/A
Materials : POLYKETONE

Halogen Content

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	With reference to EN 14582, IC	30	N.D.
Chlorine(Cl)	mg/kg	With reference to EN 14582, IC	30	N.D.
Fluorine(F)	mg/kg	With reference to EN 14582, IC	30	N.D.
Iodine(I)	mg/kg	With reference to EN 14582, IC	50	N.D.

- NOTE: (1) N.D. = Not detected. (=MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable



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▶ 认证：玩具标准



Test Report No. F690101/LF-CTSAYHA15-00804 Issued Date: 2015. 01. 28 Page 1 of 4

HYOSUNG R&D BUSINESS LABS
74, Simin-daero,
Dongan-gu, Anyang-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYH15-00804
Sample Description : M330A
Style no./Item no. : -
Order No. : -
Manufacturer : -
Country of Origin : -
Country of Destination : -
Received Date : 2015. 01. 20
Test Period : 2015. 01. 21 to 2015. 01. 28
Test Result(s) : For further details, please refer to following page(s)
Result Summary :

Test Requested	Conclusion
EN71-3: 2013 - Migration of certain elements (By all conclusive testing)	PASS
(Selected tests item as specified by the applicant, please refer to test result page(s) for details)	

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Test Report No. F690101/LF-CTSAYHA15-00804 Issued Date: 2015. 01. 28 Page 2 of 4

Test Results:

EN71-3: 2013 - Migration of certain elements

Category III: Scrapped-off toy material

Method : With reference to EN71-3:2013. Analysis of general elements was performed by ICP-OES. Chromium (III) was obtained by calculation, chromium (VI) was analyzed by IC-UV/VIS. Organic Tin was analyzed by GC-MS.

Test Item	Result (mg/kg)		Reporting Limit (mg/kg)	Permissible Limit (mg/kg)
	1			
Mass of trace amount (mg)	--	--	--	--
Soluble Aluminium (Al)	ND	50	70,000	
Soluble Antimony (Sb)	ND	10	660	
Soluble Arsenic (As)	ND	10	47	
Soluble Barium (Ba)	ND	50	18,750	
Soluble Boron (B)	ND	50	15,000	
Soluble Cadmium (Cd)	ND	5	17	
Soluble Chromium (Cr)	ND	0.15	--	
Soluble Chromium (III) (Cr (III))	ND	1	480	
Soluble Chromium (VI) (Cr (VI))	ND	0.18	0.2	
Soluble Cobalt (Co)	ND	10	130	
Soluble Copper (Cu)	ND	50	7,700	
Soluble Lead (Pb)	ND	10	160	
Soluble Manganese (Mn)	ND	50	15,000	
Soluble Mercury (Hg)	ND	10	94	
Soluble Nickel (Ni)	ND	10	930	
Soluble Selenium (Se)	ND	10	460	
Soluble Strontium (Sr)	ND	50	58,000	
Soluble Tin	ND	4.9	180,000	
Soluble Organic Tin	--	ND	--	12
Soluble Zinc (Zn)	ND	50	48,000	
Comment	PASS		--	--

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Test Item(s)	Soluble Organic Tin Result(s) (mg/kg)		MDL (mg/kg)
	T		
Methyl tin (MeT)	ND	0.5	
Di-n-propyl tin (DProT)	ND	0.5	
Butyl tin (BuT)	ND	0.5	
Dibutyl tin (DBT)	ND	0.5	
Tributyl tin (TBT)	ND	0.5	
n-Octyl tin (MOT)	ND	0.5	
Tetra-butyl tin (TeBT)	ND	0.5	
Diphenyl tin (DPHT)	ND	0.5	
Di-n-octyl tin (DOT)	ND	0.5	
Triphenyl tin (TPHT)	ND	0.5	

Sample Description :

1. Ivory pellet

- Note:
1. mg/kg = milligram per kilogram
 2. ND = Not Detected
 3. 1% = 10000 mg/kg = 10000 ppm

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