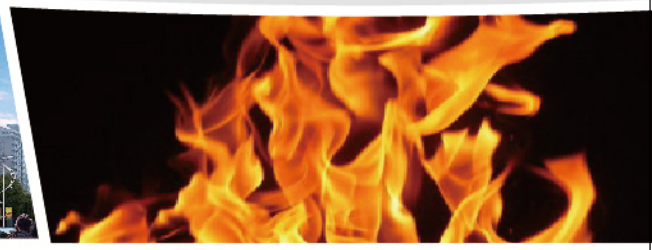
JLS®
Professional Flame Retardants

Hangzhou JLS Flame Retardants Chemical Co., Ltd

A Leading Customized HFFR Solutions Manufacturer & Supplier





JLS Business

We possess
21
national invention patents

We hold more than
70
HFFR products

We deliver in over
40
countries worldwide

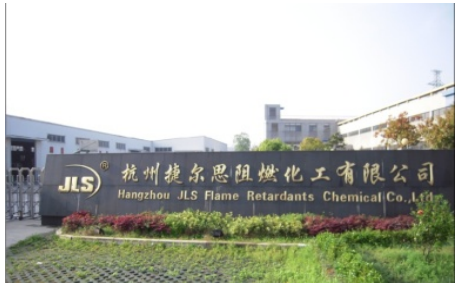
We move more than
3,500 orders/year

We focus on HFFR
18 years

Our capacity over
48,000 **tons/year**

We train over
1,200 customers
in HFFR area worldwide

JLS History



2001

- Hangzhou JLS founded

2002

- The first JLS pilot plant was established in Hangzhou

2003

- JLS Wenzhou factory was established

2006

- JLS Hangzhou factory was established
- JLS R&D center was established
- JLS was award as Hi-tech enterprise

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2014

- JLS headquarter, R&D, & material factory is operational

2015

- JLS establishes a postdoctoral program

2008

- JLS Shengzhou factory is operational

2017

- New JLS Shengzhou factory is operational - IFR capacity, 6,000 T/Y

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2018

- The newest and largest JLS Jiangshan factory is operational, capacity of APP - 20,000T/Y

2017

- JLS is recognized with the National Hi-tech Enterprise Award

2018

- JLS Hangzhou MC factory is in construction
  – Capacity 10,000 T/Y (June 2018)

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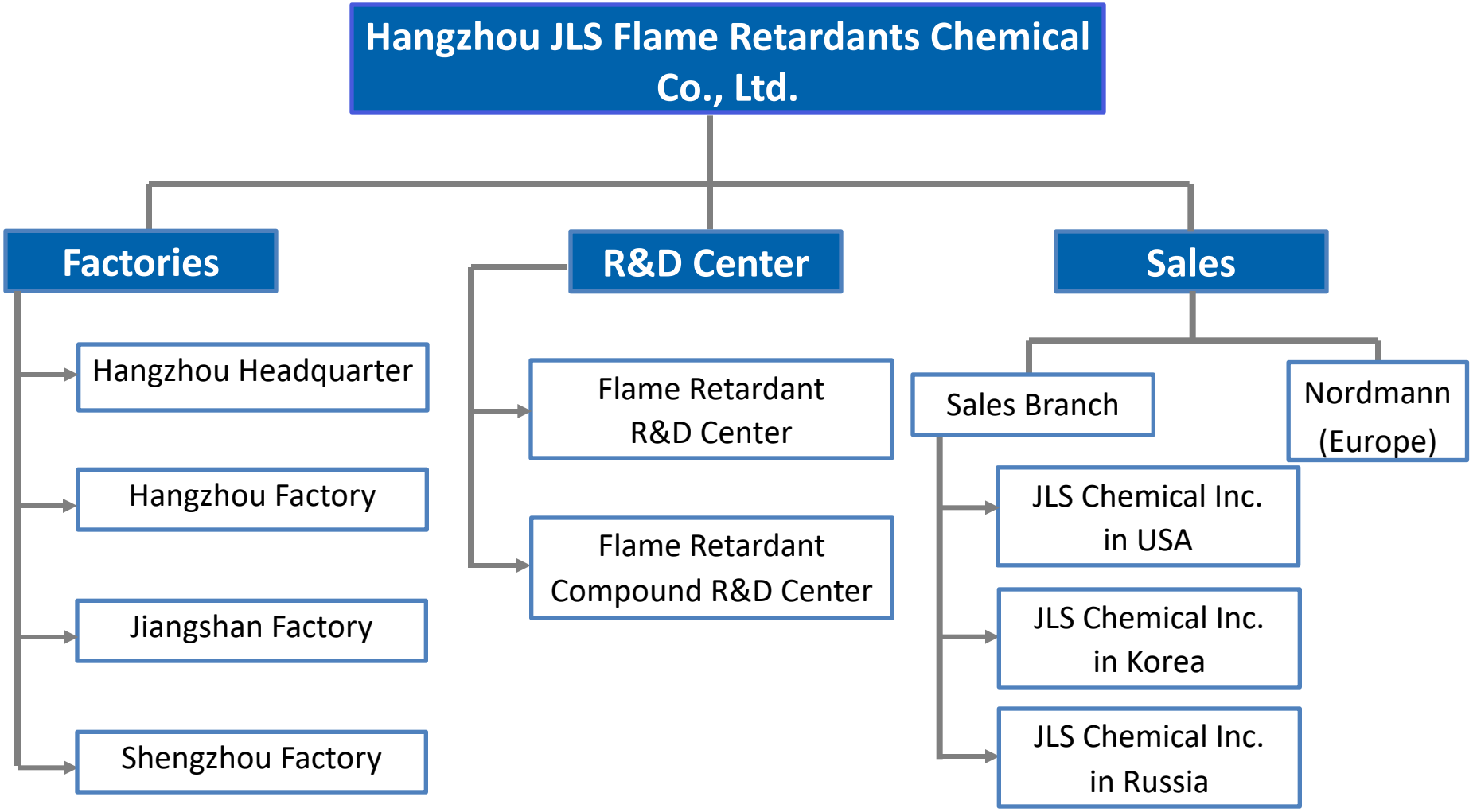
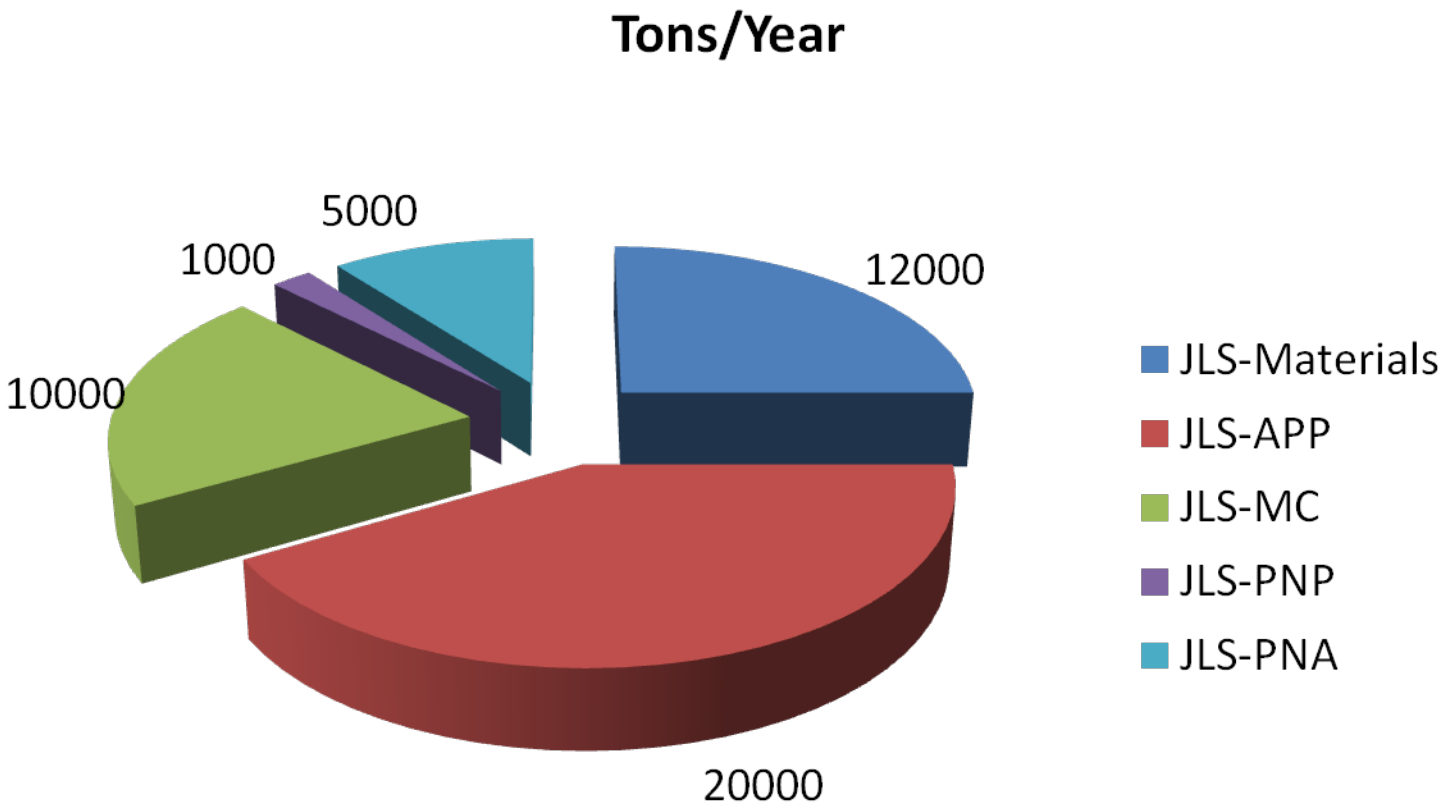
Organization



Capacity in 2018



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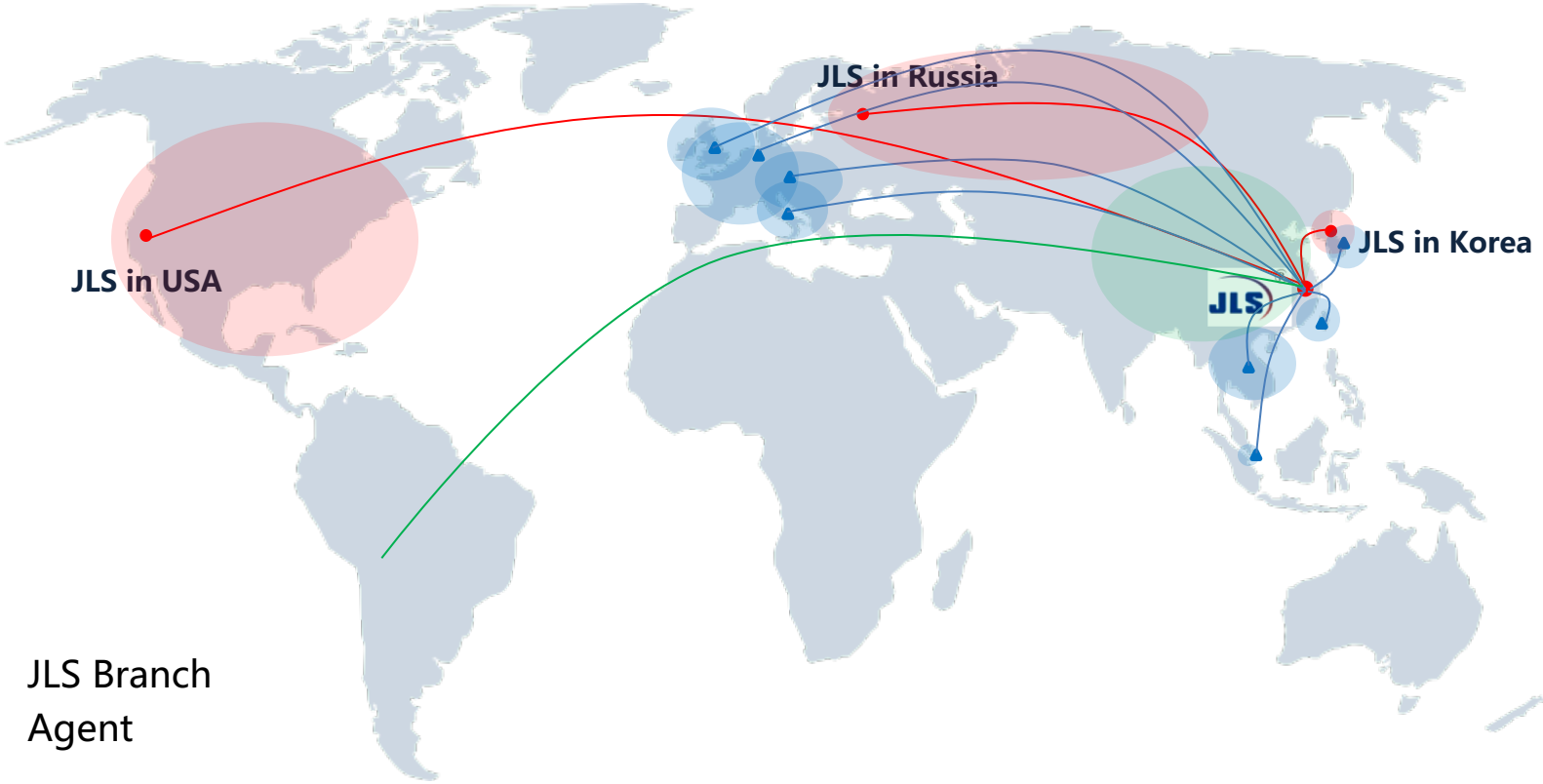
CHEMOX POUND | THE NRC GROUP | QUIMIALMEL | 三菱商事 | JSK TRADING | DKSH



NORTHSPEC NORTHSPEC CHEMICALS CORP. | Tennants | HROC H.R. Organo Chem Pvt. Ltd | 寶絡聚合物有限公司 Puro Polymers Ltd | I-TAI Chemicals Inc.

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JLS Chemical's QC lab is ISO 9001 certified.

QAC®

Quality Assurance Centre of China Association for Quality

CERTIFICATE OF QUALITY MANAGEMENT SYSTEM

Certificate No. **00616Q30697R4M**

This is to certify that the Quality Management System of

Hangzhou JLS Flame Retardants Chemical Co., Ltd.

Unified social credit code: 91330100728452261J

Registered Address: 1418-61#, Moganshan Road, Hangzhou City, Zhejiang Province, People's Republic of China (Post Code: 310011)

Audit Address: 1418-61#, Moganshan Road, Hangzhou City, Zhejiang Province, People's Republic of China (Post Code: 310011)

is in conformity with

GB/T 19001-2016/ISO 9001:2015

This certificate is valid to the following scope:

Design and Manufacture of Flame Retardants and Flame Retardant Polymer Material

Standing Branch Information: "None"

Term of validity of this certificate from: 19th.May.2016 to 18th.May.2019

Certificate Validity Information can be inquired on (www.qac.com.cn) and (www.cnca.gov.cn)

Quality Assurance Centre of China Association for Quality (QAC)

Representative:

Duan Yonggang

General Manager

Issue Date: 19th.May.2016

Modify Date: 8th.May.2018

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

CNAS 中国认可 国际互认 管理体系 MANAGEMENT SYSTEM CNAS C006-M

No.6 Baishengcun Sanhuqiao, Haidian District, Beijing 100048,P.R.China

FR Testing

Cone Calorimeter

ASTM 1354

Glow wire

IEC 60695

FR Testing

LOI

ASTM D2863

UL94

HB, V, 5V

FR Testing

UL1581 VW-1

vertical burning property of cable

FR Testing

Density of Smoke (XP-2)

ASTM D2842

JLS Product Summary

Powders

Pellets

JLS-APP (Ammonium Polyphosphates)

JLS-PNA series (Melamine Polyphosphates)

- PNA 220 (coPP, PE, TPE (Thermoplastic elastomer))
- PNA 220A, cost driven applications (Polyolefins, PE, TPE, coPP)
- PNA (for economical nylon applications)
- PNA 350 (high purity for electrical grade nylon)

JLS-PNP series

- PNP-400A, 2nd generation (thermosets, Epoxies, VER & UPR)

JLS-MC series (Melamine Cyanurate)

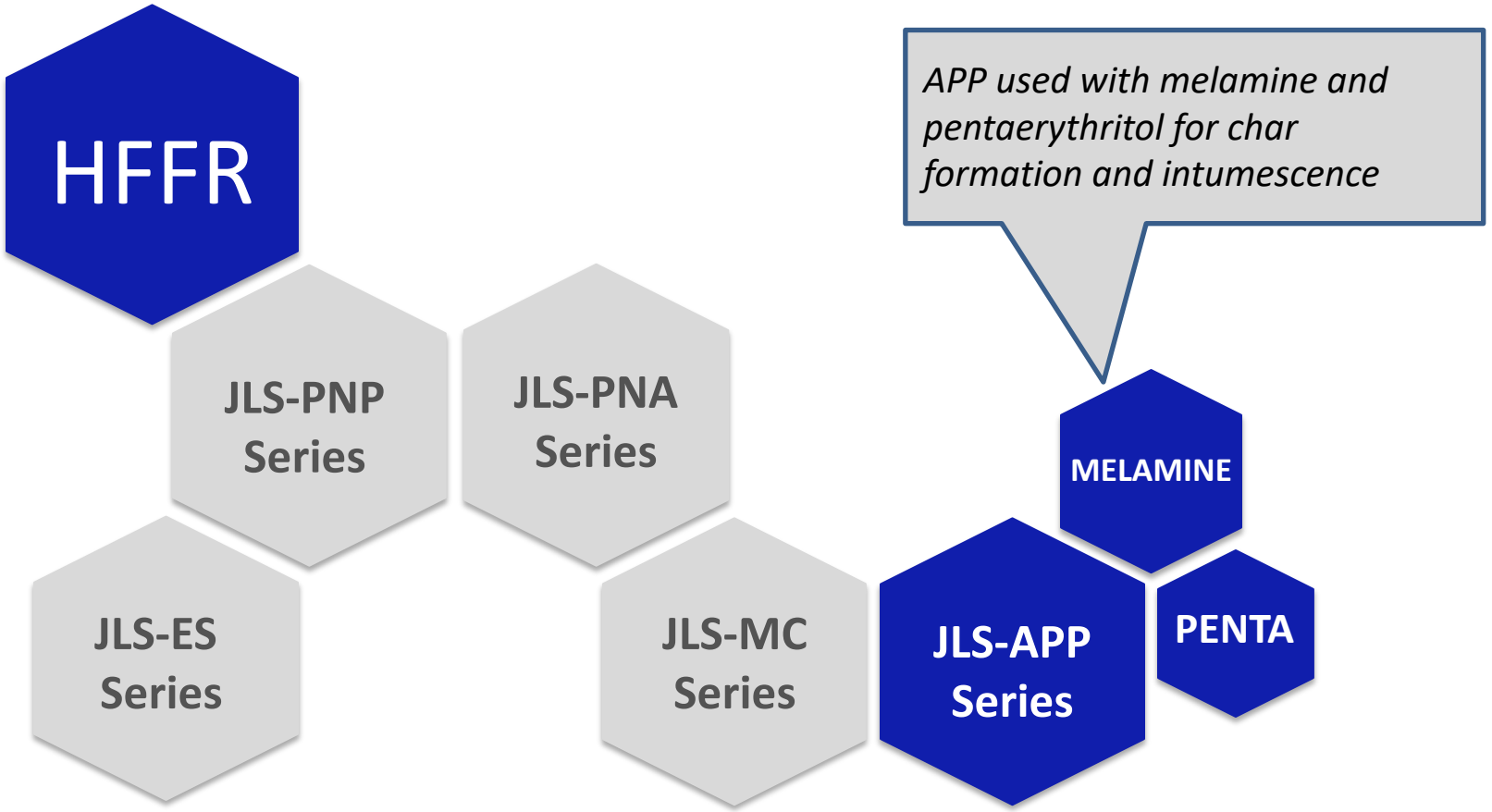
- MC15, 25, 50 (non GF nylon)

JLS-MBs (Masterbatch Concentrates)

- MB22B (PNA220A in coPP)
- MB22C (PNA220A in HDPE)
- MB32B (PNA220 in coPP)
- MB32C (PNA220 in HDPE)
- MB52C (PNA220 in LLDPE)
- MB50 (MC50 in Non GF nylon)
- MB350M (PNA350 in GF nylon)

These are economical MBs because PNA220A is a proprietary blend with APP.

APP Product line

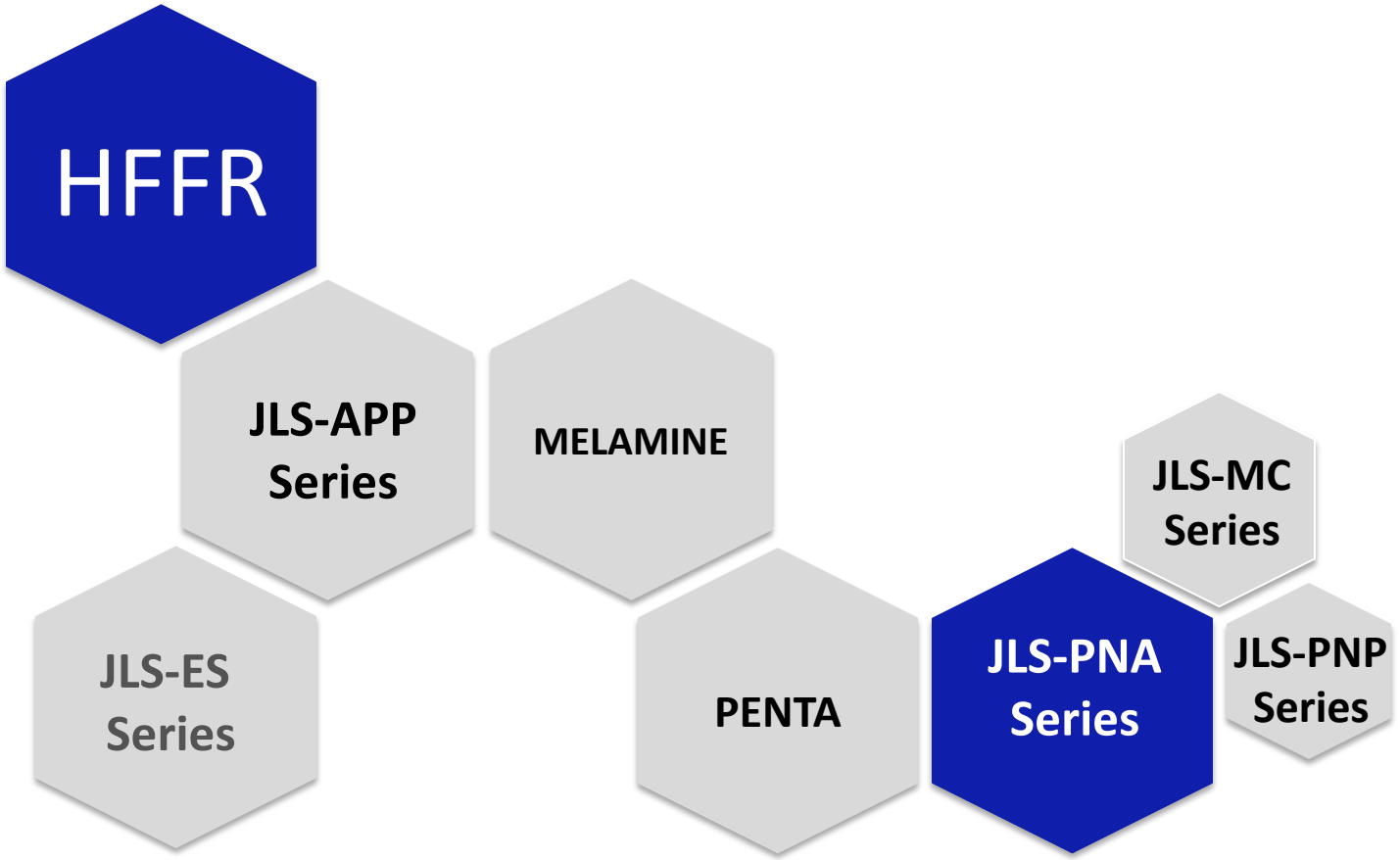


JLS-APP products – Coatings, Sealants & Adhesives

Application	Solution
Intumescent steel coating	JLS-APP、APP104MF、APP101R
Textile coating	JLS-APP, APP104、APP102
PU foam (soft foam)	JLS-APP103N
Thermoplastic materials, e.g. Polyolefin, elastomer, etc.	JLS-APP101R

JLS-APP is basic grade, which is suitable for most applications;
For highest water resistance, JLS-APP104MF is recommended;
For any special requirements, please choose corresponding APP.

JLS Products



JLS- PNA220A – Economical Solution for PE and PP

Grade	Type	P, %	TGA, 2%	Main application
PNA220-A	APP System	21±1	250	**PP**

Polyolefins – Polypropylene, Polyethylene

- Injection molding of Composites
- Lower cost than PNA220
- But….
  - Not as UV and thermally stable
  - Not as moisture resistant
- Maximum process temperature – 230° C

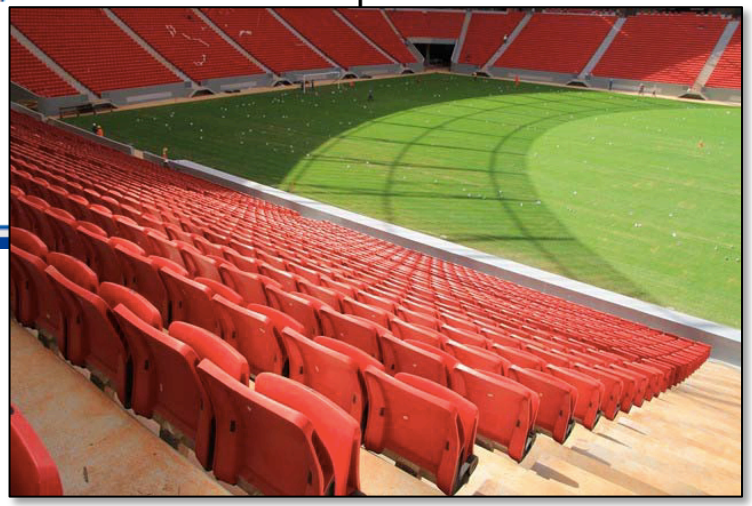
JLS- PNA220 – PE, PP, and GF PP

Grade	Type	P, %	TGA, 2%	D50 μ m	Cl	Black spot	Main application
PNA220	Non-APP System	19±1	273	5-7	ND	ND	PP, PE, TPE

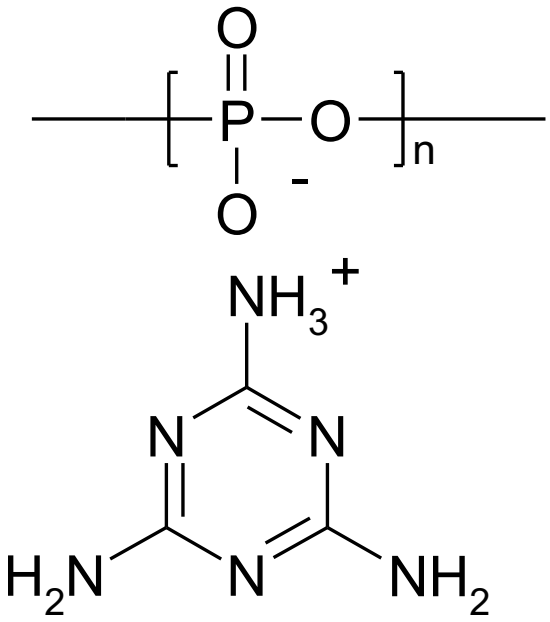
- Non-APP system – non migration
- More stable on thermal-oxidative aging ability and UV anti- yellowing ability
- Less effected on mechanical properties due to the high FR efficiency

Polyolefins – Polypropylene, Polyethylene

- Injection molding of Composites
- Sheet Extrusion
- Maximum process temperature – 270° C



JLS-PNA: Melamine Polyphosphate

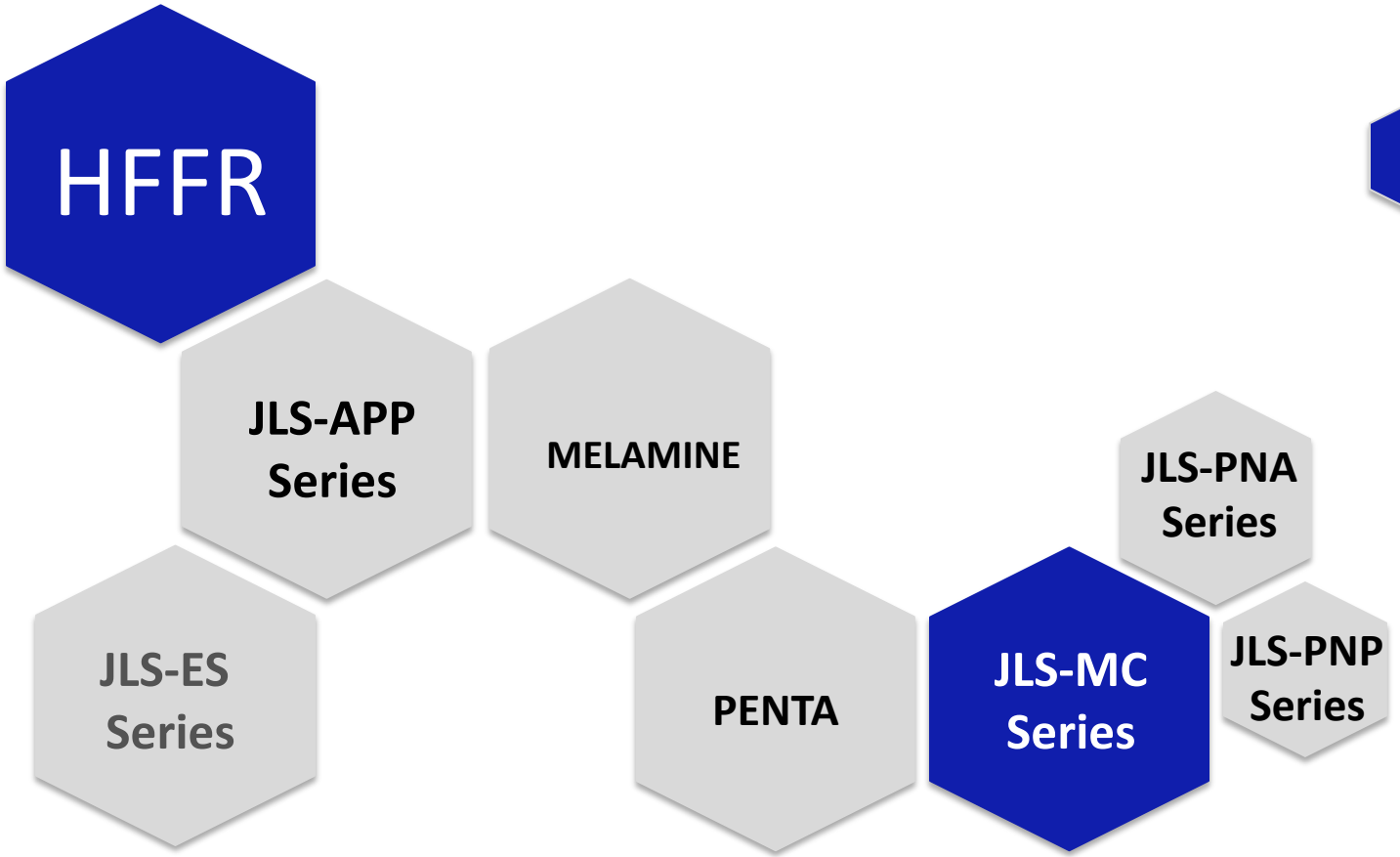


Item	PNA	PNA350
Phosphorus, %（m/m）	15±1	15±1
Weight loss 300℃×30min,%	≤ 2.0	≤ 1.0
Thermal decomposition，2%Weight loss，℃	≥300	≥350
Average particle，μm	About 10	About 10
moisture , % （m/m）	≤ 0.3%	≤ 0.3%
Apparent density , kg/L	Approx. 0.7	Approx. 0.7
pH	4.0-5.0	4.5-5.5

PNA350 has same high decomposition temperature, suitable for higher processing temperature requirement

PNA660 is a mixture based on the PNA350,which has better processability and mechanical properties in glass fiber reinforced Nylon.

JLS Products



JLS-MC SERIES

Melamine Cyanurate

Applications

JLS-MC Series is used as an effective flame retardant, primarily for E& E applications and auto industry parts made from polyamide. While MC is often used alone, it is also used regularly as an effective synergist with other FRs to improve the overall performance of the FR system.

Guidelines for use

PA6,66 unfilled	UL94 V-0 at 6–12 wt %
PA6,66 mineral filled	UL94 V-0 at 13–15 wt %
PA6 and PA66 10 - 15% glass filled	UL94 V-2 at 15–20 wt %
	Glow wire 960℃, CTI > 500 Volt

High Decomposition temperature of $\geq 330^{o}$ C allows it to be used with nylon, PET and PBT as an endothermic FR with anti drip properties

- *Versatile*
- *Economical*

JLS-MC SERIES

Melamine Cyanurate

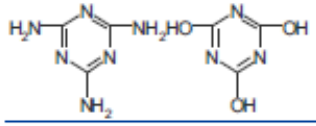
Characterization

Plate crystal structure. Halogen free Halogen free melamine based flame retardant for polyamides, polyamide masterbatch, silicone, PBT and thermoplastics.

CAS Number

37640-57-6

Chemical formula



JLS-MC grades

	MCA content	Water content	Particle size D50	Particle size D98
JLS-MC25	≥99.5%	≤0.2%	≈4μm	≤25μm
JLS-MC15 Fine powder for special applications	≥99.5%	≤0.3%	≈3μm	≤15μm
JLS-MC50 Special grade for PA masterbatch	≥99.5%	≤0.2%	≈5μm	≤50μm
JLS-MC810 Silicone treated	≥98.5%	≤0.2%	≈4μm	≤25μm

Appearance

White powder

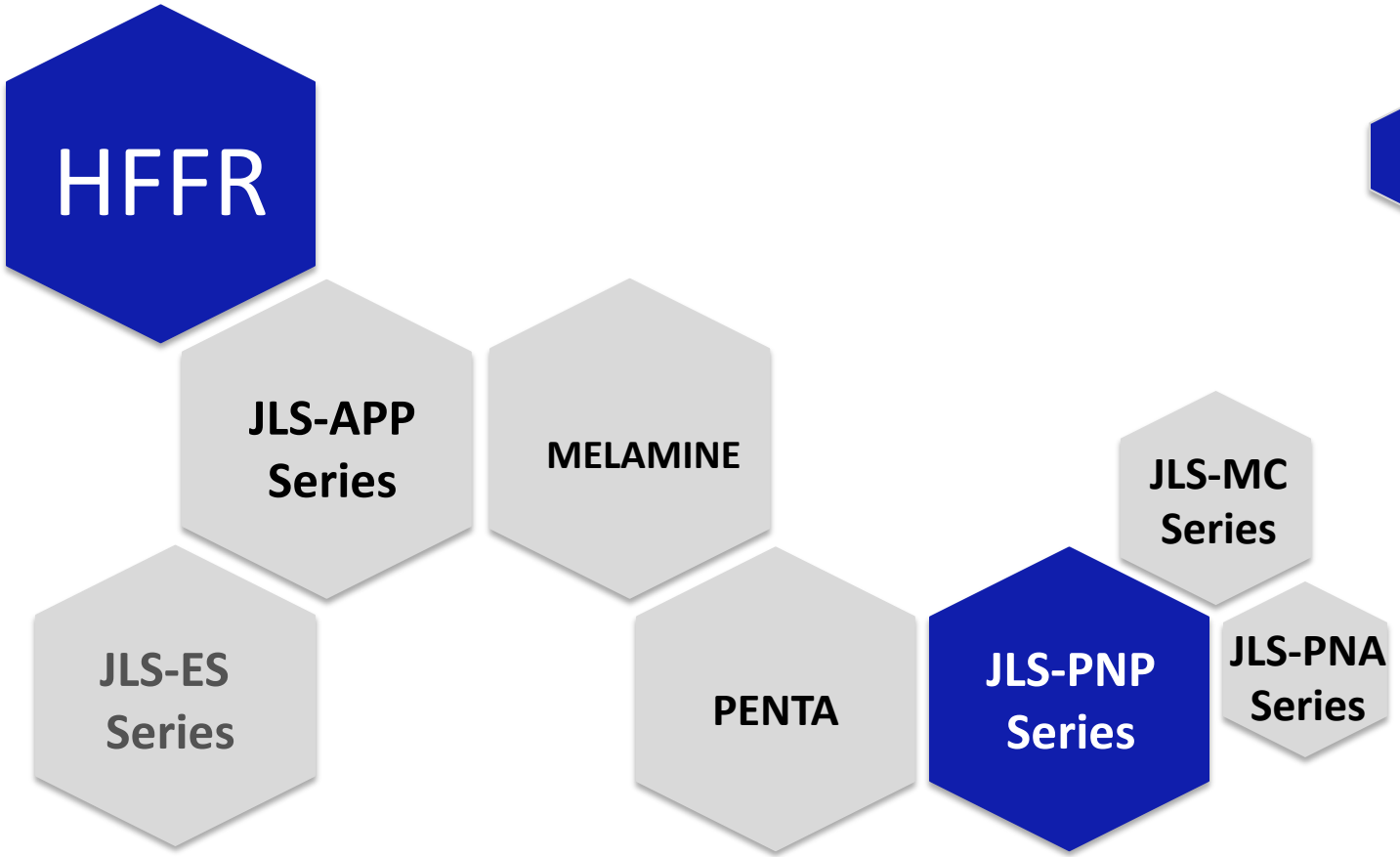
JLS-MC Series Introduction - Applications

	Nylon						PET/PBT [1]	TPU [2]	Epoxy	PP [3]	Silicon Rubber
	PA6	PA66	PA11-12	Filler modified	GF modified	PA thread					
JLS-MC15	★	★	★	★	★	★	★	★	√	√	★
JLS-MC25	★	★	★	★	★	√	★	√	√	√	★
JLS-MC50[4]	★	★		★	★				★		★
JLS-MC810	★	★		★	★	★	√	★	★	√	★

★: Successful Application
√: Developing Application

Note: 1. Must add Phosphate ester/ Phosphonate ramification as co-agent
2. Must add Phosphate ester/ Phosphonate ramification as co-agent
3. As solid lubricant
4. JLS-MC50 is mainly suitable for masterbatch

JLS Products



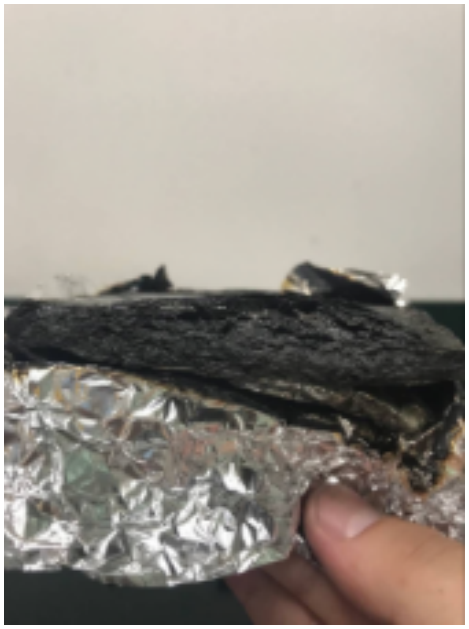
Introduction of PNP400A

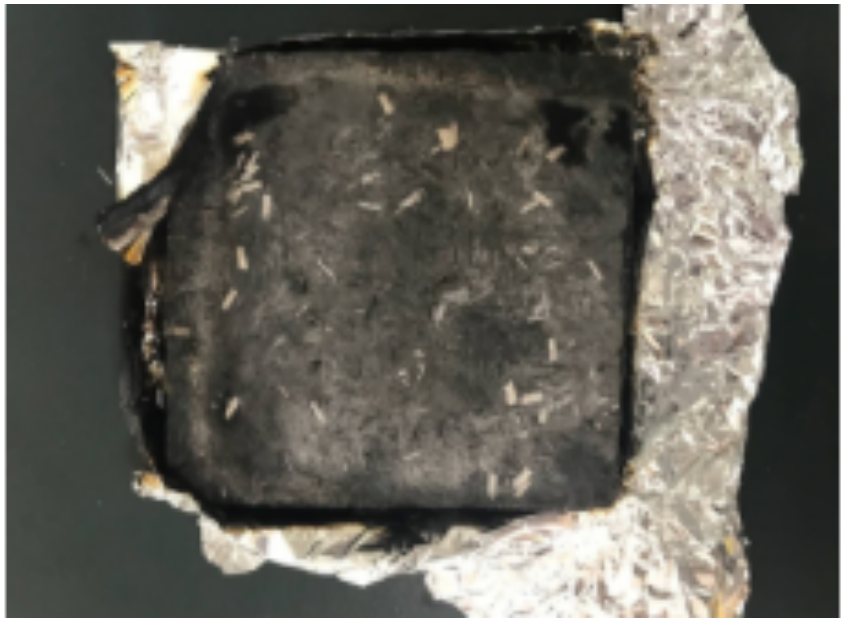
PNP400A is a nitrogen phosphorus FR for thermosets: unsaturated polyester resin (UPR), vinyl ester resin (VER), and epoxy resin.

- *Presence of fiberglass will disrupt char formation, lowering FR performance, and therefore formulating must be done with this in mind*

Product	PH	Average particle size, µm	Oil absorption, %	Performance
PNP400A	5.5-6.5	8	28-30	Halogen-free, non-toxic Excellent flame retardancy Favorable processing properties High glass contents are possible

Introduction of PNP400A





PNP400-A loading	ATH Loading	Residuals, wt.%	THR MJ/m^2	HRR-Peak kw/m^2	LOI
50 phr	---	73%	75	398	34
50 phr	20	76%	64	324	36
100 phr	---	82%	52	180	50
100 phr	20	82%	43	197	48

HFFR Concentrate

for

Masterbatch Concentrates for
- *Direct mold, injection & extrusion*
- *Highly loaded a N-P FR (75%)*
- *Dust Free*
- *TVOC*

Polyolefin
75/80% FR content

GFPA
75% FR content

PA
50% FR content

Cross-linking W+C
75% FR content

Non Cross-linking W+C
75% FR content

HFFR Concentrate listing

	FR content,%	Description
For Polyolefin / GF		
MB22B	75	PP carrier, based on PNA220-A.
MB22C	75	PE carrier, based on PNA220-A.
MB32B	75	PP carrier, based on PNA220
MB32C	75	PP carrier, based on PNA220
For Polyamide/ GF		
MB50	50	PA6 carrier, based on Melamine Cyanurate
MB350M	60	PA6 carrier, based on Melamine Polyphosphate
For W+C extrusion		
MB52C	75	PE carrier, based on a new kind of P-/N- FR system

Very popular even with compounders…

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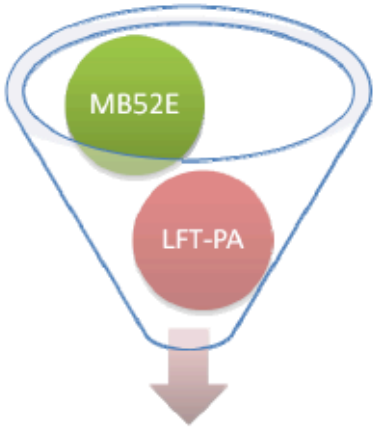
1. MBs eliminate compounding step of required by powders and go directly to injection molding

Injection Directly

2. Direct Injection lowers molded part cost for an injection molder customer



- Maximize maintaining material properties
- Shorten production cycle of downstream business
- Save energy consumption

Breaker

3.The injection molder is now our customer!!

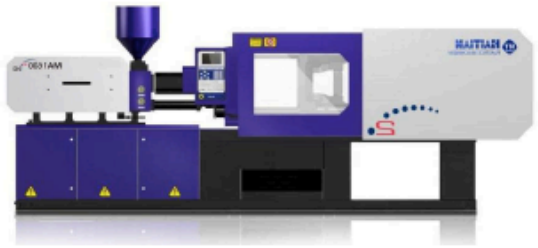
JLS Professional Flame Retardants

JLS-MB50 Features – Injection/Extrusion directly

The granules are easy to feed by side feeder or through the main feeding system

MB50

PA resins



- Corrugated Pipe
- Connector
- Breaker
- Other Nylon Products

The excellent pre-dispersion of additives will provide very good FR-properties with less active loading in the end product.

MB50 is MC50 (melamine cyanurate) dispersed in a PA carrier (non GF applications)

Thank You!

– Just Live Safety –

www.jlschemical.com