

PREVENTION IS BETTER THAN CURE!

GreenChemicals:
the best Flame
Retardants on the market

FLAME RETARDANTS: YESTERDAY, TODAY AND TOMORROW...

SMART PLASTIC
11 Novembre 2021

Micaela Lorenzi



www.greenchemicals.eu

PHYSICAL FORMS:



COMPACTED



COLD EXTRUDED



MASTERBATCH



POWDER



LIQUID BLENDS



FLAME
RETARDANTS



UV ABSORBERS
& HALS



PROCESS AID
& PEROXIDES



ANTIOXIDANTS



ANTISTATICS



LUBRICANTS

SOME OF OUR INNOVATIVE FORMULATIONS:

· PP V2 LOW HALOGEN CONTENT

· PP AND TPO V0 HALOGEN FREE
INTUMESCENT FORMULATIONS

· HIPS HALOGEN FREE FORMULATIONS

· PA HALOGEN FREE FORMULATIONS

· DECAETHANE CONCENTRATED MASTERBATCH

· PC V0 HALOGEN FREE, TRANSPARENT
APPLICATION

AGENDA

- **FLAME RETARDANTS TODAY'S CONTEST**
- **FLAME RETARDANT MECHANISMS: 1) WATER DEVELOPMENT, 2) GAS PHASE, 3) DRIPPING, 4) CHAR, 5) INTUMESCENT**
- **ENGINEERING POLYMERS FR: PA, PBT, PET, PC, PC/ABS, PPO/HIPS, ABS, HIPS, POLISOLFONI**
- **HALOGEN FREE SOLUTIONS FOR PPV2, PPV0, ABS V0, PA V0**
- **CHOICE CRITERIA**
- **CONCLUSIONS**



FLAME RETARDANT CONTEXT

ADDITIVE NOT FILLER HIGHER IN VOLUMES

2 MILLIONS/MT/Y WORLDWIDE 1752 Wyld –first patent for textiles and paper; Guy Lussac 1820, APP and Ammonium chloride and borax for fabrics for theatres in Paris; Di-bromine-methane, di chloride-ethane, as co-anti-detonating agents to TEL;
Snowballs developments only starting from 1970;

2021: Brominated flame retardants are one of additives more affected by price increase. 1/3 chinese production.

2021: P has been proposed as critical raw material, to be secured for Europe

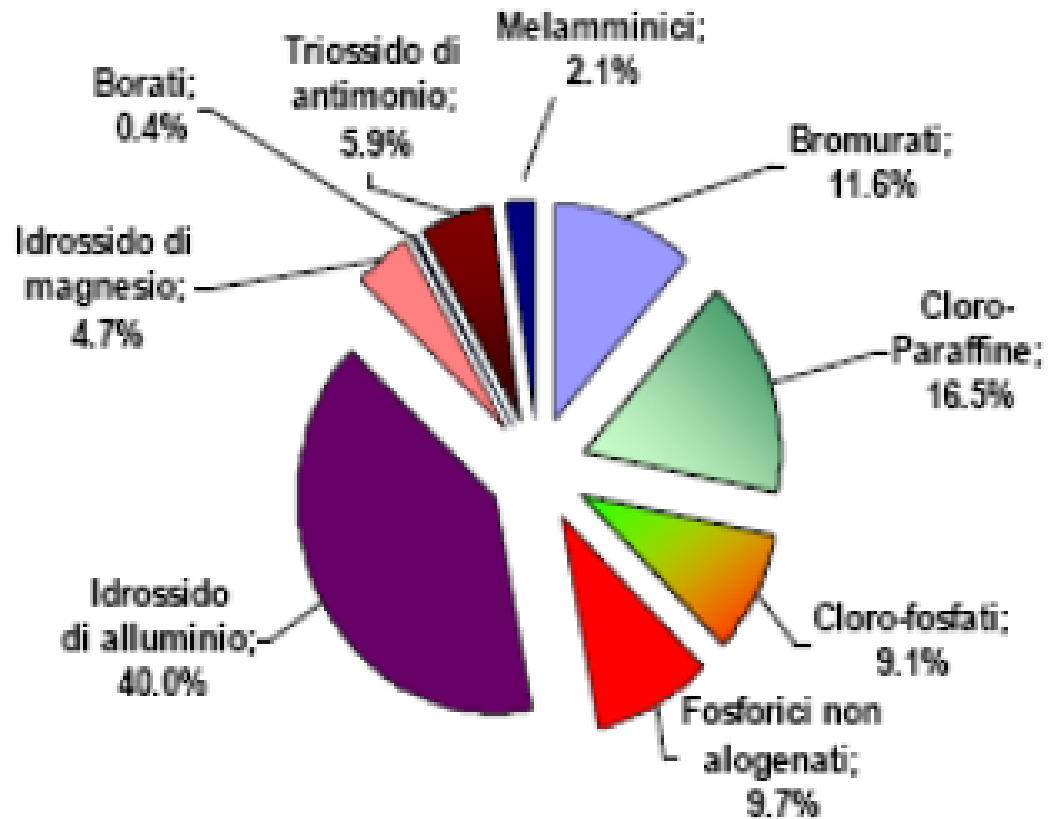
PROBLEMS RELATED TO BROMINATED FLAME RETARDANTS

- Endocrine and thyroid disruption
- Impacts to the immune system
- Reproductive toxicity
- Cancer
- Adverse effects on fetal and child development
- Neurologic function



FR SPLIT 2015

- TOXICITY
- RECYCLABILITY
- THERMAL STABILITY
- COMPATIBILITY
- COST/PERFORMANCE



FR RETARDANT MARKET

COMBUSTION

OXIDATION CHEMICAL REACTION

Development:

HEAT

FLAMES

SMOKE AND GAS

STEPS OF COMBUSTION:

HEATING

DECOMPOSITION

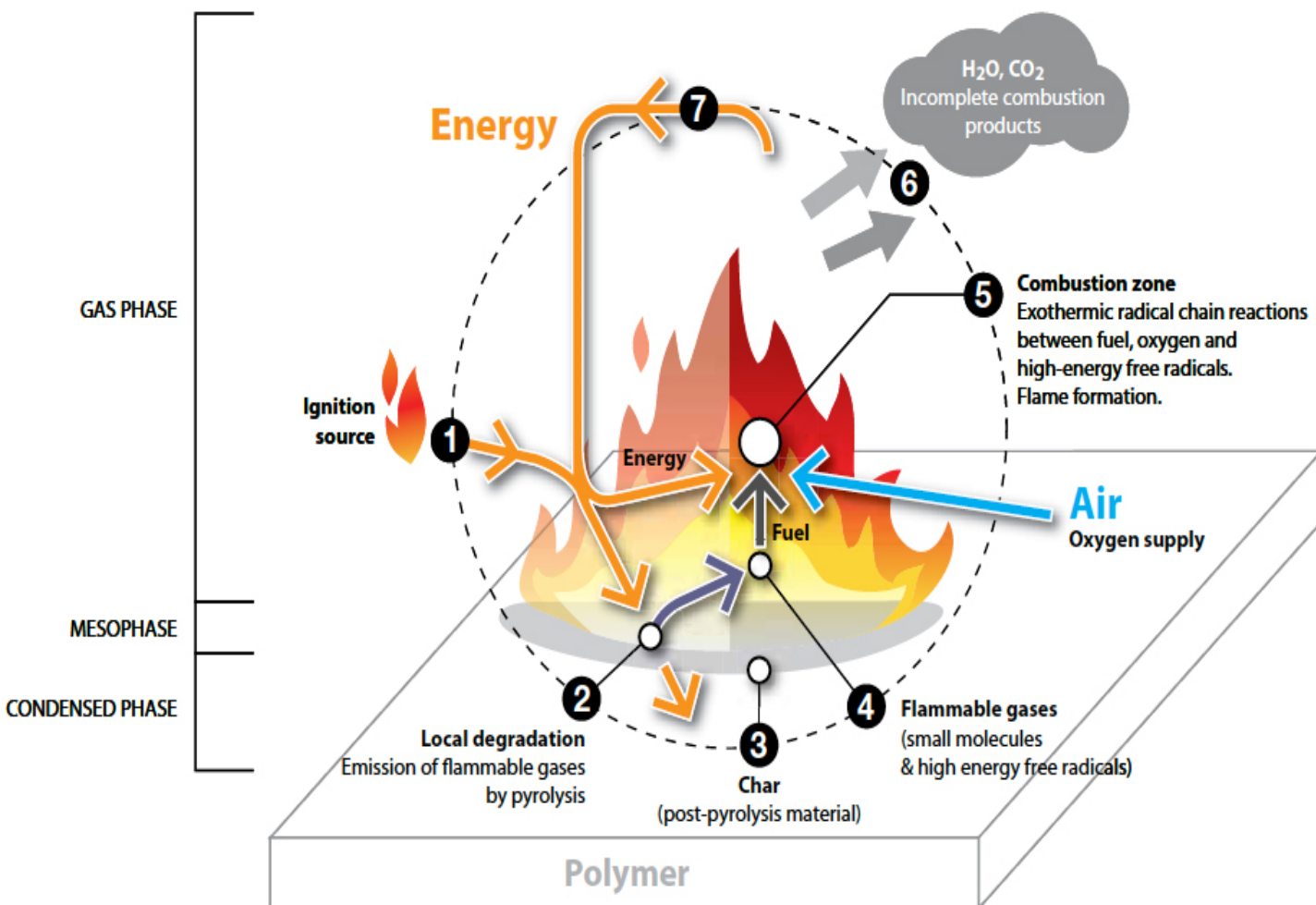
IGNITION

COMBUSTION

PROPAGATION

RADICAL REACTION

Oxygen is used by $H\bullet$ for radical chain degradation:

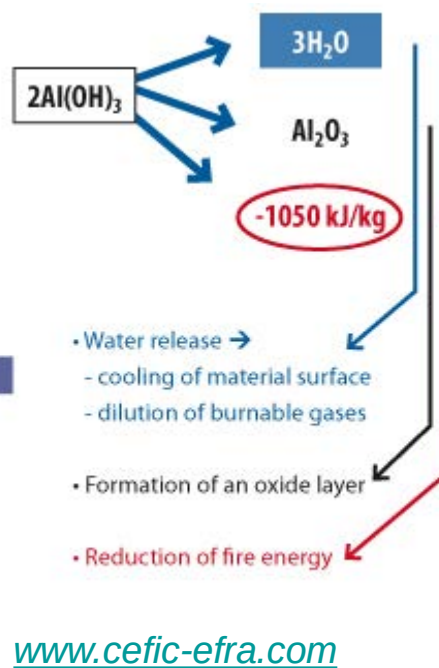
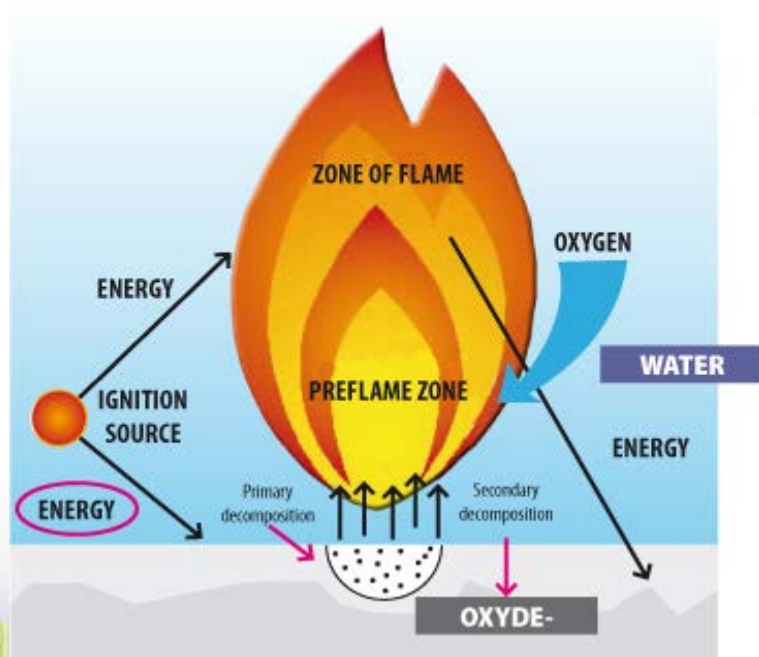
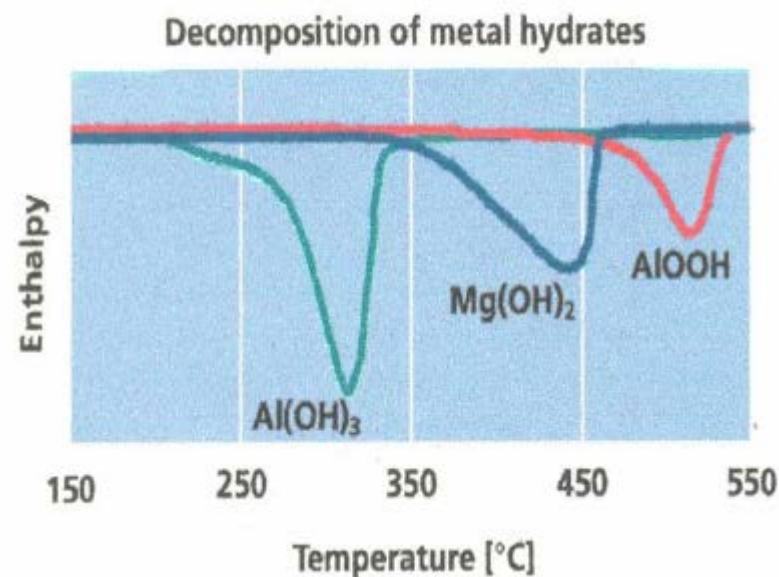


LOI: It is the minimum oxygen percentage needed to make a polymer burning

LOI: Limiting Oxygen Index

Polymer	Oxygen Index(% O ₂)
PMMA	17.3
PP	17.5
PS	17.8
Paper	18.2
ABS	18.8
PET	20.0
NORYL	24.3
PA 6,6	24.3
PC	24.9
Polifenilen ossido	30.0
Polisolfone	38.0
PVC	40.3
PTFE	95.0

1) MECHANISM WATER DEVELOPMENT

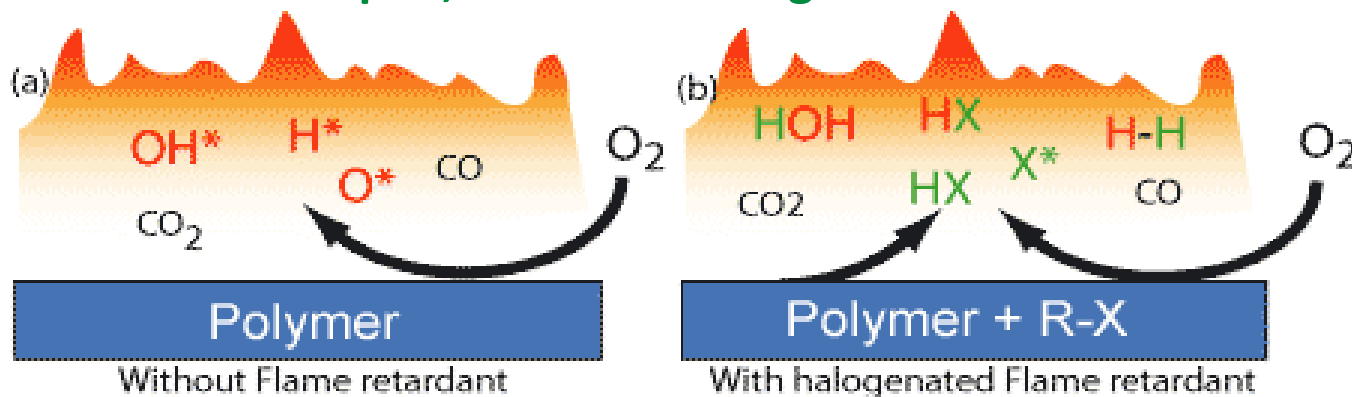


**PHISYCAL MECHANISM IN
CONDENSED PHASE AND GAS
PHASE**

Cooling down
Dilution of oxygen, LOI
decreasing

2) MECHANISM GAS PHASE - brominated

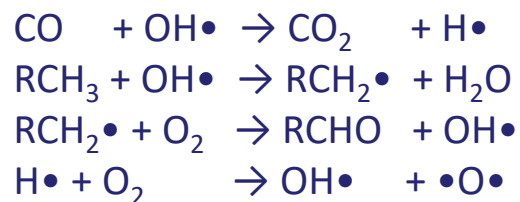
Brominated flame retardants, with help of antimony trioxide, generate HBr and radicals, which block radical chain degradation of polymer during fire. HBr developed, dilute also oxygen and inhibits fire.



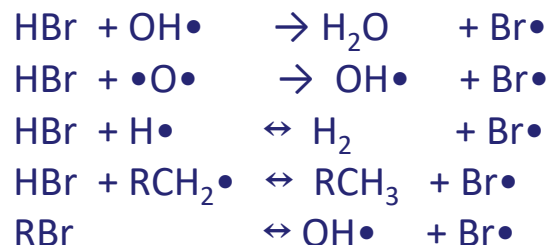
Gas phase radical Br mechanism

Example:
 $\text{Br-FR} + \text{Sb}_2\text{O}_3$

Hydrocarbons burning



Br Flame retardant action



Flame retardant with Sb_2O_3



DIFFERENT KIND OF PHOSPHORUS

P0

RED P

P1

PHOSPHINATES

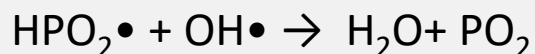
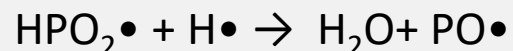
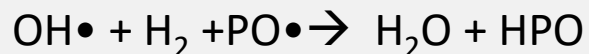
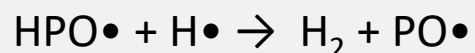
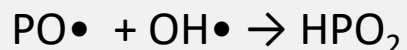
P3

PHOSPHONATES

P5

PHOSPHATES

P Flame retardant action in gas phase



Not all P molecules are able to react in the gas phase.

Suitable P compounds must be volatile during polymer pyrolysis.

In addition to this, ability of P to act in gas phase is higher, as lower is the oxidation number.

Phosphate>Phosphonate>Phosphinate>Pred

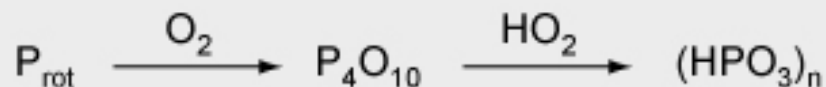
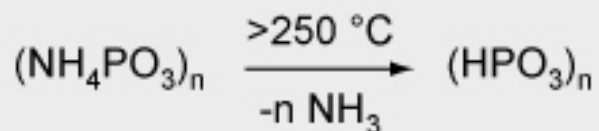
3) CHAR MECHANISM CONDENSED PHASE

P3 and P5

CHEMICAL AND PHYSICAL REACTION IN SOLID PHASE

Polymer char, who inhibits pyrolysis and reduce oxygen flux to fresh polymer.

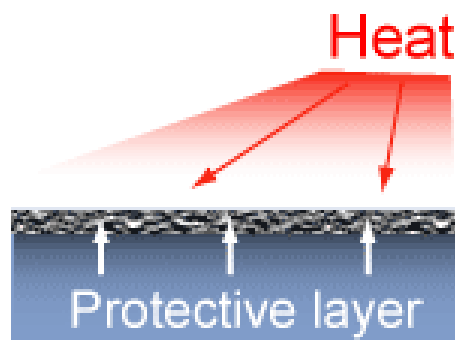
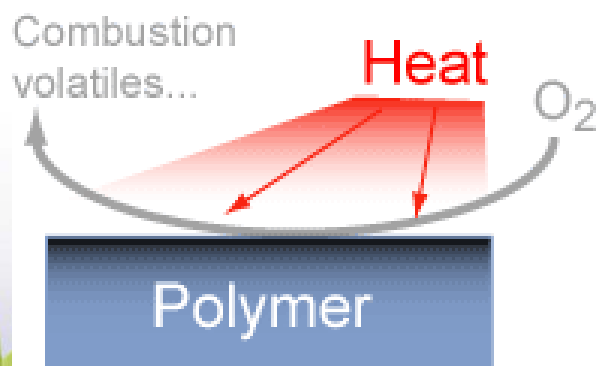
P based products dehydrate polymer and create char layers.



REACTIVE SYSTEM:

P BASED PRODUCTS

BETTER WITH POLYMERS WITH
HETEROATOMS



4) INTUMESCENT MECHANISM

P5 and N

Example of reactive syste:

CHARING AGENT

P BASED INORGANIC ACID

N BASED FOAMING AGENT

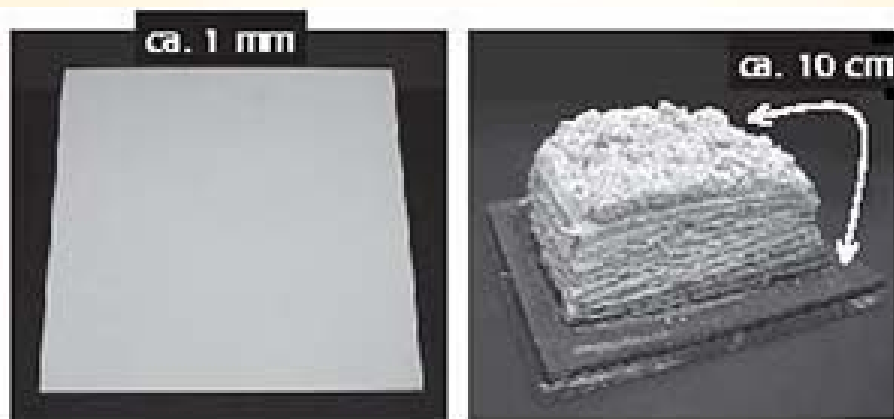
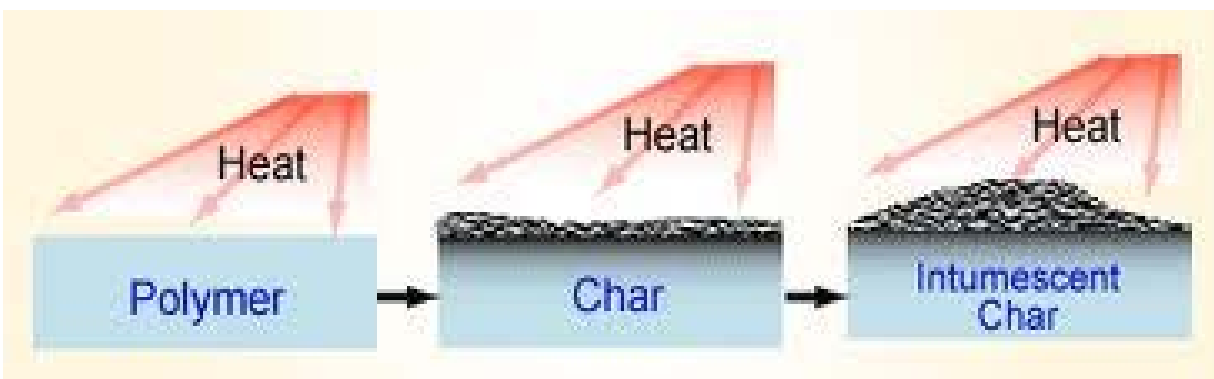
CHEMICAL ACTION

SOLID PHASE REACTION

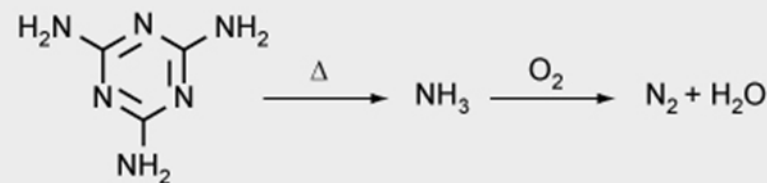
Dehydration and degradation of polymer with char formation.
Protective layer swelling.

GAS PHASE ACTION

Not flammable gas formation.



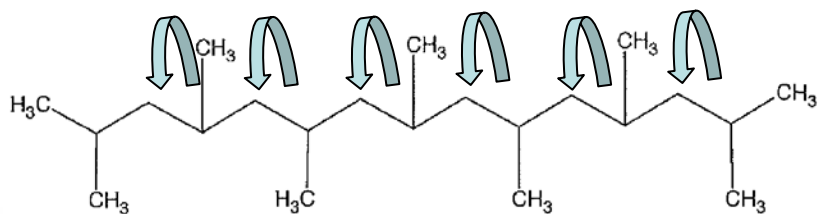
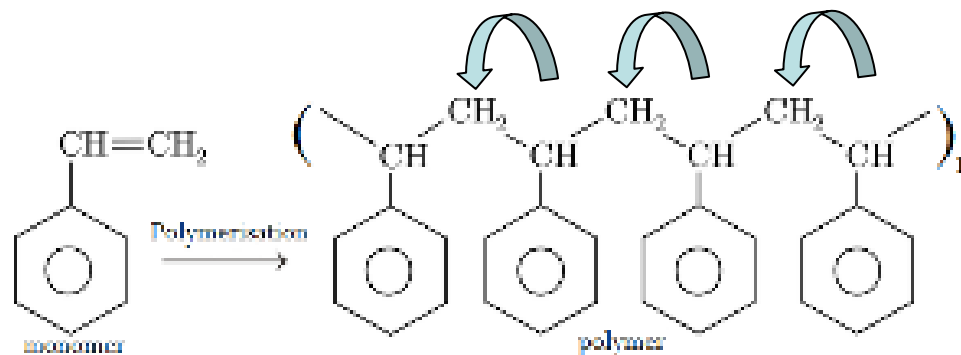
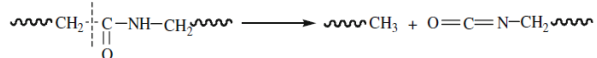
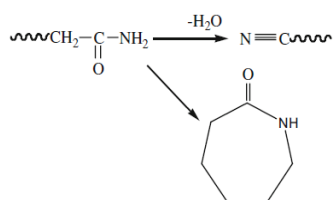
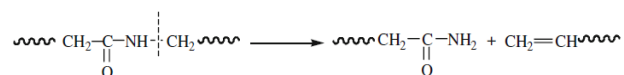
The thickness of the intumescent foam increases 10 to 100 fold that of the originally applied coating and insulates the substrate by its low thermal conductivity.



5) DRIPPING/CHAIN SCISSION MECHANISM

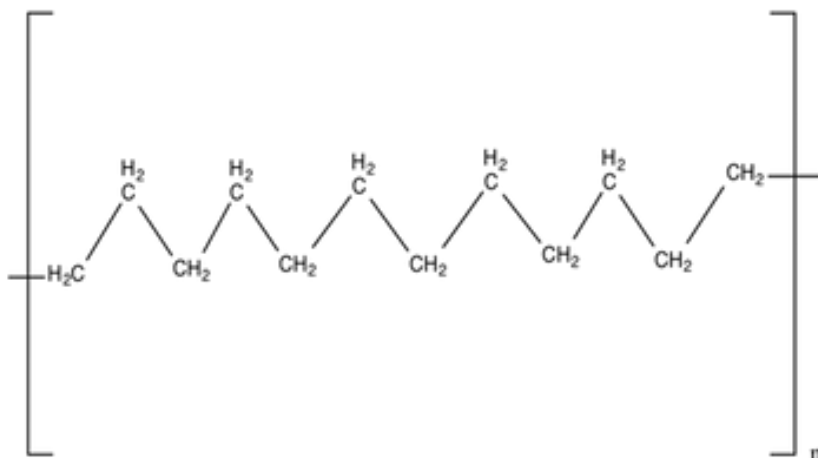
CHEMICAL ACTION IN GAS PHASE

Flame retardant, after heating, generates active radicals, which cut polymer chains, making the polymer from solid to liquid, which is an endothermic reaction.



PO-PS POLYETHYLENE

LOI



PE	17
ABS	18
PA	24
PC	27
PTFE	95

MAIN FEATURES

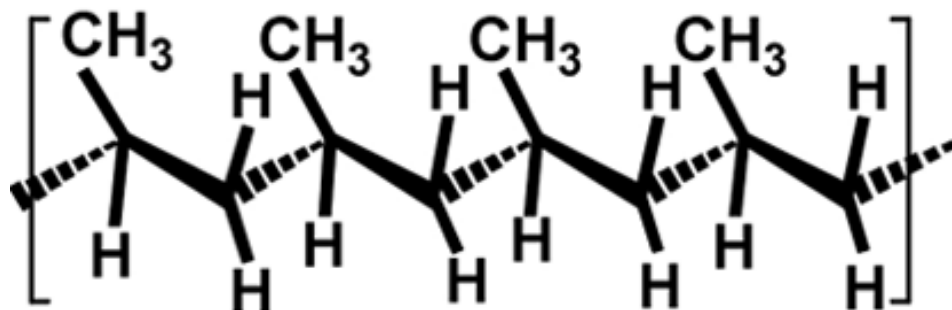
HIGH LOI	BAD FLAME RETARDANT RESISTANCE
<u>N</u> AND <u>O</u> IN CHAIN	ALL FLAMABLE GASES
LOW PROC. TEMP. 190° C-230° C	WIDE RANGE OF FR
NO PRESENCE OF N AND O	BAD CHAR
RADICAL POLYMERIZATION	HARD DRIPPING
CROSS-LINKING ABILITY	VERY BAD

PS-PO: POLYETHYLENE/TPR

	WHAT	TEST	+	-	MECHANISM
OLD TECH	METAL HYDROXIDE	-	NO HEALTHY AND ENVIROMENTAL PROBLEMS	HIGH DOSAGE	WATER DEVELOPEMENT
OLD TECH	DECA-OXIDE/ Sb_2O_3 $[ZnBO_3]$	UL94 V0	LOW DOSAGE LOW COST	KILLED FOR HEALTHY AND ENVIROMENTAL PROBLEMS	WATER DEVELOPMENT
TODAY	DECA ETHANE / Sb_2O_3 $[ZnBO_3]$	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	GC BT ₆₇ / Sb_2O_3 $[ZnBO_3]$	UL94 V0	LOW DOSAGE LOW COST GOOD DISPERSION GOOD MECHANICAL PROPERTIES GOOD COLOR	COST BROMINE ANTIMONY	GAS-PHASE
TODAY	P red	UL 94 V0	LOW COST HALOGEN FREE LOW DOSAGE	RED COLOR EXPLOSIVE	CHAR
TODAY	GC PP HF ²⁰⁰ GC PP HF ¹⁰⁰⁰ GC DOPO SIN	UL94 V0	HALOGEN FREE WHITE COLOR	DISPERSION * HEAT STABILITY DOSAGE PROCESSABILITY MECHANICA PROPERTIES	INTUMESCENT GAS PHASE
TODAY	NOR HALS ¹¹⁶ GC DOPO	UL94 V2	LOW DOSAGE HALOGEN FREE	HIGH COST	DRIPPING

PO-PS POLYPROPYLENE

LOI



PE	17
ABS	18
PA	24
PC	27
PP	17

CARATTERISTICHE

CONSEGUENZE

HIGH LOI	BAD FLAME RETARDANT RESISTANCE
<u>N</u> AND <u>O</u> IN CHAIN	ALL FLAMABLE GASES
LOW PROC. TEMP. 200° C-280° C	WIDE RANGE OF FR
NO PRESENCE OF N AND O	BAD CHAR
RADICAL POLYMERIZATION / ZIEGLER NATTA	DRIPPING
CROSS-LINKING ABILITY	VERY BAD

	WHAT	TEST	+	-	MECHANISM
OLD TECH	METAL HYDROXIDE	-	NO HEALTHY AND ENVIROMENTAL PROBLEMS	HIGH DOSAGE	WATER DEVELOPEMENT
OLD TECH	DECA-OXIDE/ Sb_2O_3 ($ZnBO_3$)	UL94 V0	LOW DOSAGE LOW COST	KILLED FOR HEALTHY AND ENVIROMENTAL PROBLEMS	WATER DEVELOPMENT
TODAY	DECA ETHANE /Sb_2O_3 ($ZnBO_3$)	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	GC BDDP ⁶⁸/Sb_2O_3 ($ZnBO_3$)	UL94 V0 UL 94 V2	LOW DOSAGE LOW COST GOOD DISPERSION GOOD MECHANICAL PROPERTIES GOOD COLOR	COST BROMINE ANTIMONY	GAS-PHASE DRIPPING
TODAY	P red	UL 94 V0	LOW COST HALOGEN FREE LOW DOSAGE	RED COLOR EXPLOSIVE	CHAR
TODAY	GC PP HF ²⁰⁰  GC PP HF ¹⁰⁰⁰  GC DOPO	UL94 V0	HALOGEN FREE WHITE COLOR	DISPERSION * HEAT STABILITY DOSAGE PROCESSABILITY MECHANICA PROPERTIES	INTUMESCENT GAS PHASE
TODAY  	GC DRIPP HF ⁷⁰ GC DOPO SIN GC HF ⁴⁰	UL94 V2	LOW DOSAGE HALOGEN FREE	LOW COST ONLY VERGIN PP	DRIPPING GAS PHASE



GC DRIPP HF 70 GC DRIPP HF 70 UV



GREEN AND INNOVATIVE FLAME RETARDANT
FOR CORRUGATED PIPES, HOUSE MACHINES
AND HOUSEHOLD DEVICES

» LOW HOLOGEN!

IT GUARANTEES BROMINE CONTENT < 900 ppm

» LOW DOSAGE FOR VERY GOOD MECHANICAL
PROPERTIES! Loading level is only between 1 and 2%

» VERY GOOD UV RESISTANCE!

This clean and low halogen formulation allows to have a very good UV resistance of final product. UV resistance can be improved up to 1000 hours, by adding specific packages, present in GC DRIPP HF

» HIGH THERMAL STABILITY AND EXCELLENT
PROCESSABILITY

FOR MORE INFORMATIONS PLEASE CONTACT US!



www.greenchemicals.eu

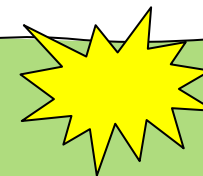
✉ Info@greenchemicals.green

☎ Phone: 0362 1547305

NEW!

• GC HF 40

• GC HF 40 UV



GREEN AND INNOVATIVE FLAME RETARDANT FOR
POLYPROPYLENE AND POLYSTYRENE FOR BUILDING
INDUSTRY

TOTAL HALOGEN FREE!

VERY GOOD UV RESISTANCE!

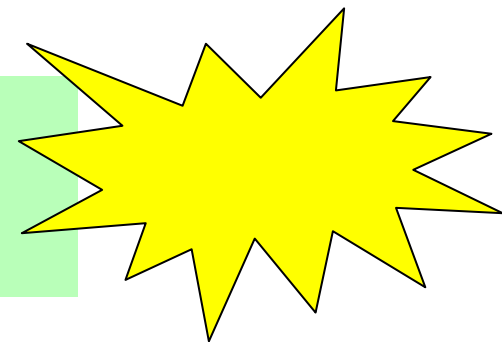
This clean and low halogen formulation allows to have a very good UV resistance of final product. UV resistance can be improved up to 1000 hours, by adding specific packages

GC HF 40 WORKS VERY WELL ALSO WITH RECYCLED
POLYMERS



FOR MORE INFORMATIONS PLEASE CONTACT US!

- **GC PP HF 200**
- **GC PP HF 1000**



PP HF 200 and PP HF 1000 are P/N intumescent flame retardants, based on APP and PiPP molecules. It allows strong halogen free flame retardancy even with much lower loading level than others halogen free systems

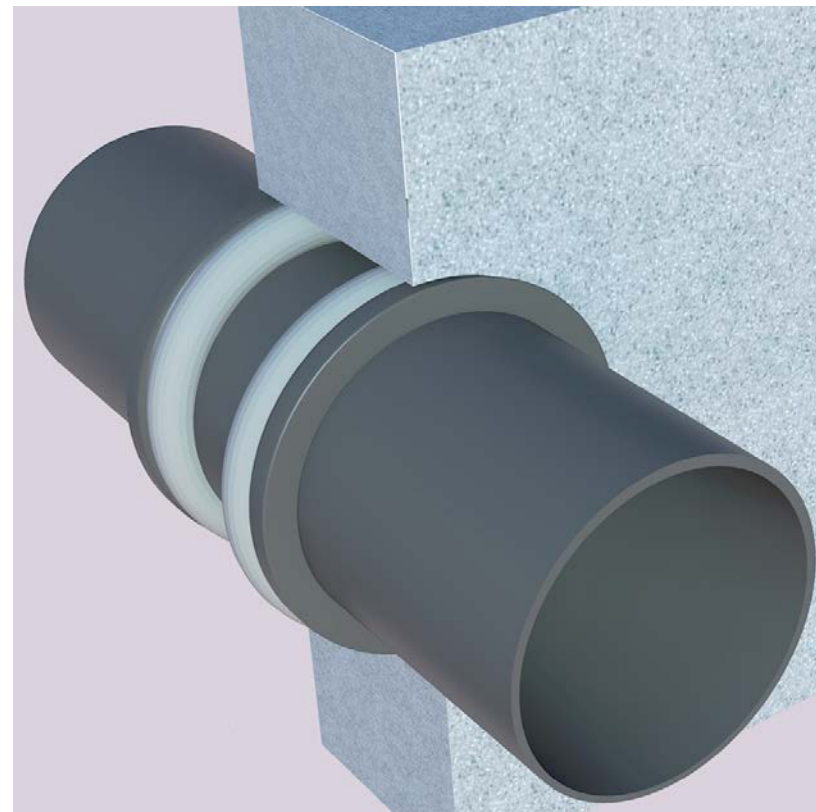
TOTAL HALOGEN FREE

VERY GOOD UV RESISTANCE!

This clean and low halogen formulation allows to have a very good UV resistance of final product. UV resistance can be improved up to 1000 hours, by adding specific packages

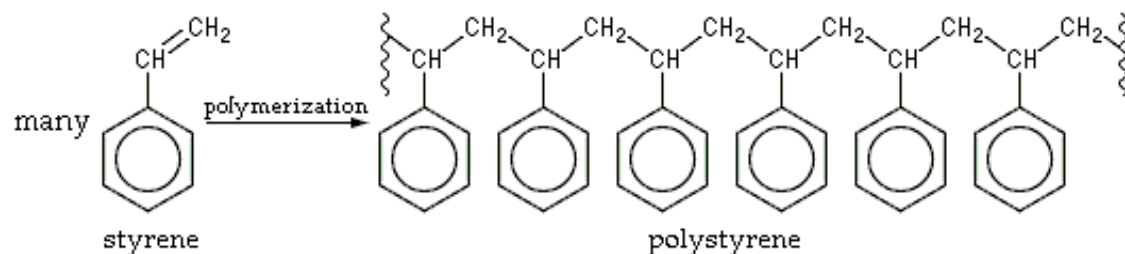
GC PP HF 200 AND GC PP HF 1000 Works very well in combination of 2% od Setacomp PP

FOR MORE INFORMATIONS PLEASE CONTACT US!



PO-PS POLYSTYRENE

LOI



PE	17
ABS	18
PA	24
PC	27
PS	18

CARATTERISTICHE

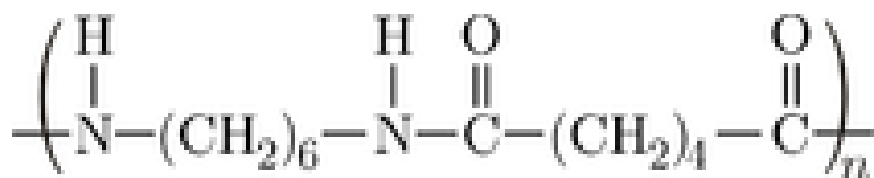
CONSEGUENZE

HIGH LOI	BAD FLAME RETARDANT RESISTANCE
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LOW PROC. TEMP. 180° C-280° C	WIDE RANGE OF FR
NO PRESENCE OF N AND O	BAD CHAR
RADICAL POLYMERIZATION	HARD DRIPPING
CROSS-LINKING ABILITY	VERY BAD

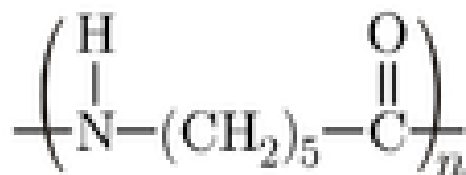
POLYSTYRENE GPPS AND HIPS

	WHAT	TEST	+	-	MECHANISM
OLD TECH	DECA-OXIDE/ Sb_2O_3 (ZnBO_3)	UL94 V0	LOW DOSAGE LOW COST	KILLED FOR HEALTHY AND ENVIROMENTAL PROBLEMS	WATER DEVELOPMENT
TODAY	DECA ETHANE /Sb_2O_3 (ZnBO_3)	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	GC BDDP ⁶⁸ (/DC) (Sb_2O_3) GC BDMP ⁶⁶ (/DC) GC TBC ⁶⁶ (/DC) PFR (/ DC)	UL 94 V2	LOW DOSAGE LOW COST GOOD DISPERSION GOOD MECHANICAL PROPERTIES GOOD COLOR	COST BROMINE ANTIMONY	DRIPPING GAS PHASE
TODAY	P red	UL 94 V0	LOW COST HALOGEN FREE LOW DOSAGE	RED COLOR EXPLOSIVE	CHAR
TODAY	GC PP HF ²⁰⁰ GC PP HF ¹⁰⁰⁰ 	UL94 V0	HALOGEN FREE WHITE COLOR	DISPERSION * HEAT STABILITY DOSAGE PROCESSABILITY MECHANICA PROPERTIES	INTUMESCENT
TODAY	GC FR ²⁴⁵ / Sb_2O_3	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR GOOD IMPACT	BROMINE ANTIMONY	GAS PHASE
TODAY	GC DOPO SIN GC HF₄₀ 	UL94 V0	HALOGEN FREE WHITE COLOR	COST LOADING LEVEL	GAS PHASE + CHAR

ETP: POLYAMIDE



Nylon 66



Nylon 6

LOI

PE	17
ABS	18
PA	24
PC	27
PTFE	95

HIGH LOI	GOOD FLAME RESISTENCE
<u>N</u> AND <u>O</u> IN CHAIN	LESS FLAMMABLE GASES
HIGH PROCESSING T, 230° C – 280° C	FR MUST BE THERMAL RESISTANT
PRESENCE OF N AND O	CHAR
POLICONDENSATION	DRIPPING
CROSS-LINKING ABILITY	CROSS-LINK

ENGINEERING POLYMERS: POLYAMIDES

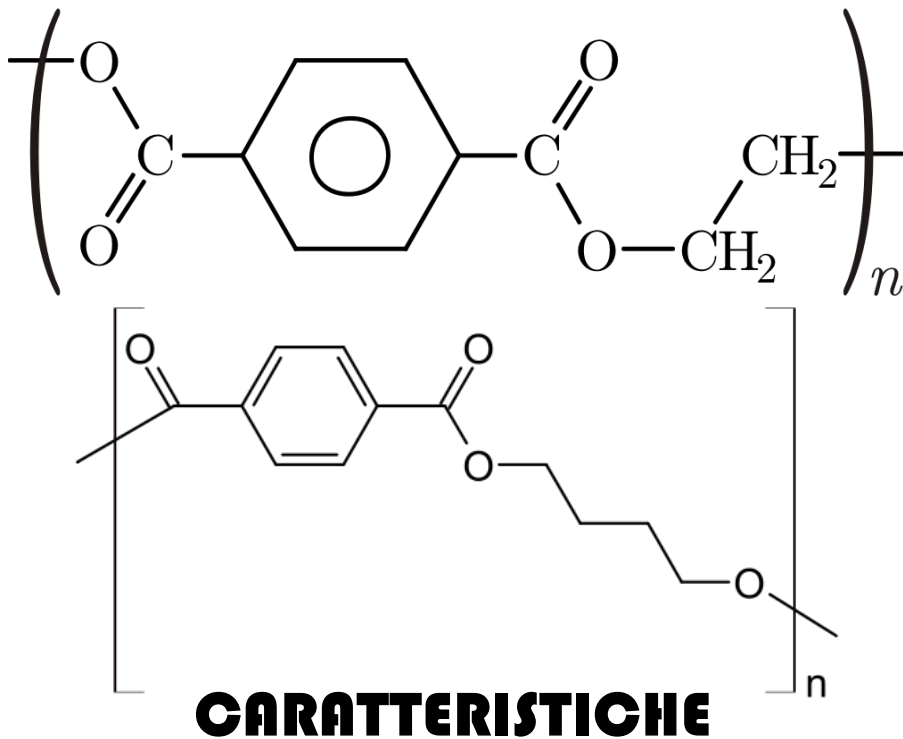
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TODAY	DECA ETHANE / Sb_2O_3 ($ZnBO_3$)	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	PBS/ Sb_2O_3 ($ZnBO_3$) (BeO)	UL94 V0	LOW DOSAGE LOW COST GOOD THERMAL STABILITY GOOD MECHANICAL PROPERTIES	COST BROMINE ANTIMONY	GAS-PHASE
TODAY	P red	UL 94 V0	LOW COST HALOGEN FREE LOW DOSAGE	RED COLOR EXPLOSIVE	CHAR
TODAY	PHOSPHINATE/MC/ MPP/ $ZnBO_3$ GC HF PAP ₁ GC HF PAP ₁₂ 	UL94 V0	HALOGEN FREE WHITE COLOR GOOD MECHANICAL PROPERTIES	COST HEAT STABILITY DOSAGE PROCESSABILITY	CHAR DRIPPING GAS-PHASE
TODAY	MELAMINE CYANURATE	UL94 V2 (V0)	LOW COST LOW DOSAGE HALOGEN FREE	NO V0 IF FG FILLED	DRIPPING (CHAR)

ENGINEERING POLYMERS: POLYAMIDES

	WHAT	TEST	+	-	MECHANISM
TOMORROW	REACTIVE FLAME RETARDANTS	UL94 V0	POLYMERIC COST MIGRATION FREE HALOGEN FREE BETTER THERMAL AND MECHANICAL PROPERTIES	ONLY IN POLYMERIZATION	CHAR DRIPPING GAS-PHASE
TOMORROW	NANOCOMPOSITE ORGANO CLAY	UL94 V0	HALOGEN FREE VERY ACTIVE IN LOW CONCENTRATION	COST R&D AVAILABILITY	CHAR DRIPPING CROSS-LINK
TODAY/ TOMORROW	MISCELLANEOUS MPP, APP, MELAMINE CYANURATE P1 e P3	UL94 V0	HALOGEN FREE COST	THERMAL STABILITY HYGROSCOPICITY ACTIVITY	CHAR DRIPPING CROSS-LINK



ENGINEERING POLYMERS: POLY ETHYLEN TEREPHTALATE POLY BUTYLEN TEREPHTALATE



LOI

PE	17
ABS	18
PET	25
PBT	23
PC	27
PTFE	95

% O < PET

CONSEQUENZE

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HIGH PROCESSING T, 230° C – 280° C	FR MUST BE THERMAL RESISTANT
PRESENCE OF N AND O	CHAR
POLYCONDENSATION	DRIPPING
CROSS-LINKING ABILITY	CROSS-LINK

ENGINEERING POLYMERS: POLY ETHYLEN TEREPHTALATE POLY BUTYLEN TEREPHTALATE

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TODAY	P red	UL 94 V0	LOW COST HALOGEN FREE LOW DOSAGE	RED COLOR EXPLOSIVE	CHAR
TODAY	PHOSPHINATE/MC/ MPP/ ZnBO_3 GC HF PAP 1B GC HF PAP 193 	UL94 V0	HALOGEN FREE WHITE COLOR GOOD MECHANICAL PROPERTIES	COST HEAT STABILITY DOSAGE PROCESSABILITY	CHAR DRIPPING GAS-PHASE
TODAY	MELAMINE CYANURATE	UL94 V2 (V0)	LOW COST LOW DOSAGE HALOGEN FREE	NO Vo IF FG FILLED	DRIPPING (CHAR)

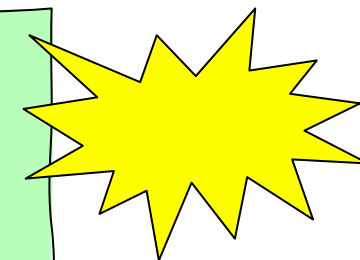
ENGINEERING POLYMERS: POLY ETHYLEN TEREPHTALATE POLY BUTYLEN TEREPHTALATE

	WHAT	TEST	+	-	MECHANISM
TOMORROW	REACTIVE FLAME RETARDANTS	UL94 V0	POLYMERIC COST MIGRATION FREE HALOGEN FREE BETTER THERMAL AND MECHANICAL PROPERTIES	ONLY IN POLYMERIZATION	CHAR DRIPPING GAS-PHASE
TOMORROW	NANOCOMPOSITE ORGANO CLAY	UL94 V0	HALOGEN FREE VERY ACTIVE IN LOW CONCENTRATION	COST R&D AVAILABILITY	CHAR DRIPPING CROSS-LINK
TODAY/ TOMORROW	MISCELLANEOUS MPP, APP, MELAMINE CYANURATE P₁ e P₃	UL94 V0	HALOGEN FREE COST	THERMAL STABILITY HYGROSCOPICITY ACTIVITY	CHAR DRIPPING CROSS-LINK



HALOGEN FREE FOR PA

GC PAP 1
GC PAP 12
GC PAP 13



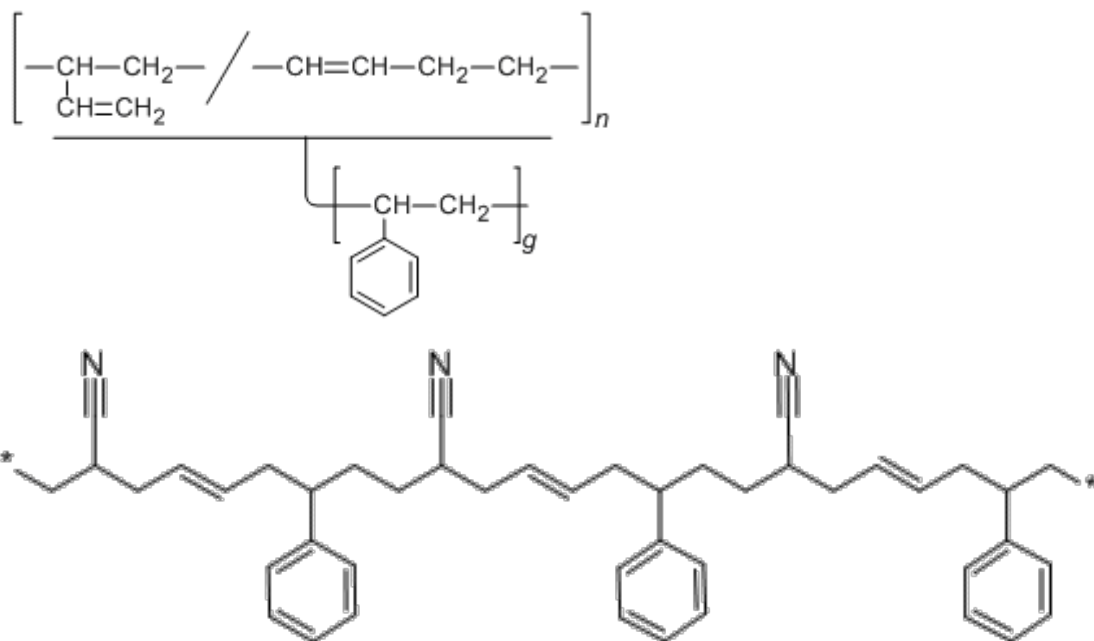
GC PAP SERIES ARE SPECIFIC FORMULATIONS FOR PA6, PA66, PBT, PET, COMPLETELY HALOGEN FREE, WHICH CAN BE TAILOR MADE AND STUDIED FOR SPECIFIC NEEDS. THEY ARE SUITABLE FOR UL94 V0. THEY CAN BE FORMULATED WITH SPECIFIC ADDITIVES TO PROVIDE HIGH RECYCLING DEGREE.

TOTAL HALOGEN FREE!
VERY GOOD UV RESISTANCE!
THERMAL STABILITY!
COLOURABILITY
TAILOR MADE FORMULATIONS
FOR SPECIFIC NEEDS!

FOR MORE INFORMATIONS PLEASE CONTACT US!



ENGINEERING POLYMERS: ABS / HIPS



LOI

HIPS	17
ABS	18
PET	25
PBT	23
PC	27
PTFE	95

HIGH LOI

BAD FLAME RETARDANT RESISTANCE

N AND O IN CHAIN

ALL FLAMABLE GASES

LOW PROC. TEMP. > 200° C

WIDE RANGE OF FR

NO PRESENCE OF N AND O

BAD CHAR

RADICAL POLYMERIZATION

HARD DRIPPING

CROSS-LINKING ABILITY

VERY BAD

HALOGEN FREE FOR ABS

GC ABS DA 73

GC ABS DA 73 IS A COMPLETELY HALOGEN FREE FORMULATION STUDIED FOR PRESERVING AS MUCH AS POSSIBLE IMPACT OF ABS COMPOUND. IT'S WHITE, WITH GOOD PROCESSABILITY AND GOOD UV RESISTANCE.

TOTAL HALOGEN FREE!
VERY GOOD UV RESISTANCE!
THERMAL STABILITY!
COLOURABILITY
TAILOR MADE FORMULATIONS
FOR SPECIFIC NEEDS!

FOR MORE INFORMATIONS PLEASE CONTACT US!

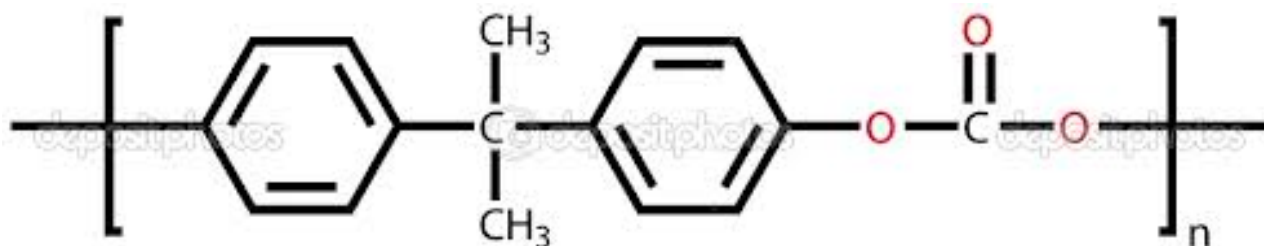


ENGINEERING POLYMERS: ABS / HIPS

	WHAT	TEST	+	-	MECHANISM
OLD TECH	DECA-OXIDE / Sb₂O₃ (ZnBO₃)	UL94 V0	LOW DOSAGE LOW COST	KILLED FOR HEALTHY AND ENVIROMENTAL PROBLEMS	WATER DEVELOPMENT
TODAY	DECA ETHANE / Sb₂O₃ (ZnBO₃)	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	GC BDDP ⁶⁸ (/ DC) (Sb₂O₃) GC BDMP ⁶⁶ (/ DC) GC TBC ⁶⁶ PFR (/ DC)	UL 94 V2	LOW DOSAGE LOW COST GOOD DISPERSION GOOD MECHANICAL PROPERTIES GOOD COLOR	COST BROMINE ANTIMONY	DRIPPING GAS PHASE
TODAY	GC PP HF ²⁰⁰ GC PP HF ¹⁰⁰⁰	UL94 V0	HALOGEN FREE WHITE COLOR	DISPERSION * HEAT STABILITY DOSAGE PROCESSABILITY MECHANICA PROPERTIES	INTUMESCENT
TODAY	GC FR ²⁴⁵ / Sb₂O₃	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR GOOD IMPACT	BROMINE ANTIMONY	GAS PHASE
TODAY/TOMO RROW	GC PP HF ²⁰⁰⁺ DEPAL	UL94 V0	HALOGEN FREE WHITE COLOR	DISPERSION * HEAT STABILITY DOSAGE PROCESSABILITY MECHANICA PROPERTIES	INTUMESCENT /GAS PHASE

ENGINEERING POLYMERS: POLYCARBONATE

LOI



PE	17
ABS	18
PET	25
PBT	23
PC	27
PTFE	95

HIGH LOI	VERY GOOD FLAME RESISTENCE, ALREDY V2
<u>N</u> AND <u>O</u> IN CHAIN	LESS FLAMMABLE GASES
HIGH PROCESSING T, 240° C – 280° C	FR MUST BE THERMAL RESISTANT
PRESENCE OF N AND O	CHAR
POLYCONDENSATION	DRIPPING careful to acid
CROSS-LINKING ABILITY	CROSS-LINK

ENGINEERING POLYMERS: POLYCARBONATE AND...

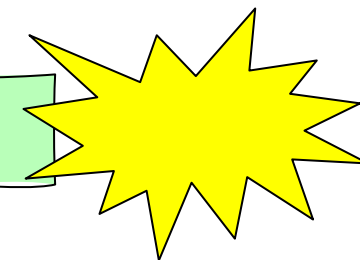
	WHAT	TEST	+	-	MECHANISM
TODAY	DECA ETHANE/Sb ₂ O ₃ ,	UL94 V0	LOW DOSAGE LOW COST GOOD COLOR	BROMINE ANTIMONY POOR THERMAL STABILITY	GAS-PHASE
TODAY	PC OLYGOLERS, {ZnBO ₃ } {BEO} BT ₉₃	UL94 V0	LOW DOSAGE LOW COST GOOD THERMAL STABILITY GOOD MECHANICAL PROPERTIES	COST BROMINE ANTIMONY	GAS-PHASE
TODAY	RDP/BDP/GC HF 693	UL 94 V0	LOW COST HALOGEN FREE	HALOGEN FREE TRANSPARENCY LOW THICKNESS	CHAR
TODAY	KSS (K salt di diphenyl solphone solphonate, with or without PMS (polimetilsilossano) GC PC HF ₉₀	UL94 V0	HALOGEN FREE WHITE COLOR GOOD MECHANICAL PROPERTIES VERY LOW DOSAGE	THICKNESS	CHAR DRIPPING GAS-PHASE
TODAY	GC PC HF ₉₀	UL94 V0	HALOGEN FREE WHITE COLOR GOOD MECHANICAL PROPERTIES VERY LOW DOSAGE LOW THICKNESS	NO COLOUR	DRIPPING (CHAR)

...PC/ABS

TODAY	TPP, RDP, BDP	UL94 V0	HALOGEN FREE COST LOW DOSAGE	THERMAL STABILITY PHYSICAL FORM	CHAR
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HALOGEN FREE FOR PC

GC PC HF90



GC PC HF 90 IS A COMPLETELY HALOGEN FREE FORMULATION, WHICH IS GUARANTING LOW DOSAGE, TRANSPARENCY AND POSSIBILITY TO REACH UL94 V0 @ 1,6mm

TOTAL HALOGEN FREE!
VERY GOOD UV RESISTANCE!
THERMAL STABILITY!
TRANSPARENCY
TAILOR MADE FORMULATIONS
FOR SPECIFIC NEEDS!

FOR MORE INFORMATIONS PLEASE CONTACT US!



IN COOPERATION WITH



CONCLUSIONI

- SI CERCANO ANTIFIAMMA FR HALOGEN FREE O A BASSO IMPATTO PER LA SALUTE E AMBIENTALE
- LA CHIMICA DEL P E' QUELLA PIU' VICINA E PRONTA PER SOSTITUIRE I BROMURATI;
- ETP SI PRESTANO MEGLIO A FR INNOVATIVI, COME ANTIFIAMMA REATTIVI;
- NANOCOMPOSITI, ORGANOCCLAY
- POLIMERI SUPER FR PER LEGHE

**SOLUZIONE
IDEALE**

