



The Clear Choice for Flame Retardant Plastics



nofia®

“The Future is Plastics”

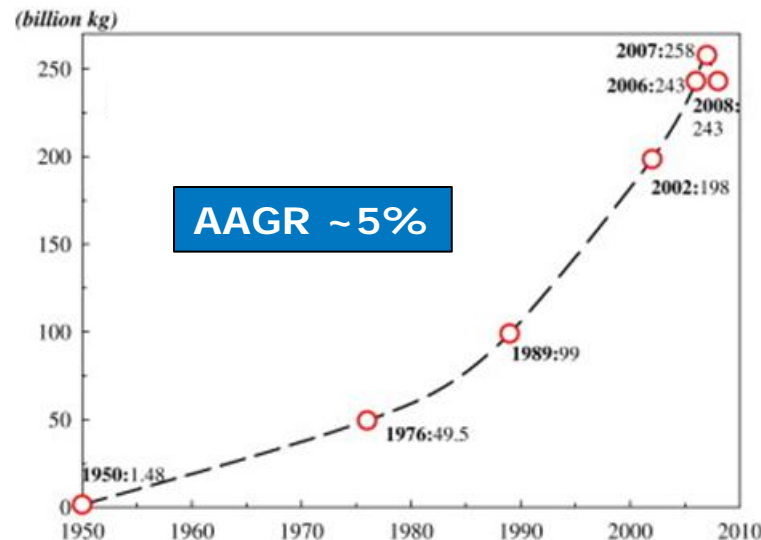
The Graduate (1967) with Dustin Hoffman:

“There's a great future in plastics. Think about it. Will you think about it?”



Early plastics (back in the middle ages!) were bio-derived materials (animal and vegetable proteins).

Today, the majority of the plastics are oil-based but there's a trend back to bio-derived materials (e.g. PLA)



2015: ~300MM TPA

1967: ~25MM TPA

~5% of all Plastics contain Flame Retardants

Electrical Equipment and Consumer Electronics (EE&CE)



Housings



Wire and cable



PCB's



Connectors



Mcb's

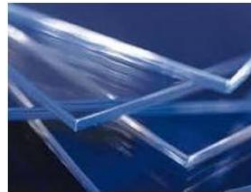
Building & Construction (B&C)



Carpeting



Thermoplasts



Sheet



Laminates



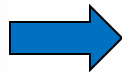
Lighting

Transportation



Why Flame Retardants?

- **Wikipedia:** “materials used in plastics to that inhibit or resist the spread of fire”
- 2 – 2.5 million fires each year in Europe
- In 2007, about 3,000 fire fatalities in EU, 4,000 in USA, and 2,000 in Japan.
- At least 90% of these fire deaths occurred in homes and buildings
- Direct and indirect costs of fires ~ 1% of GDP in developed world
- Today, homeowners would have less than 3 min to get out of a burning house compared to 17 min in the 1970's



A Revolution is Taking Place!

Bromine containing Flame Retardants:

- Persistent
- Bio Accumulates
- Toxic in animal tests
- Continuous pressure from NGOs on OEMS



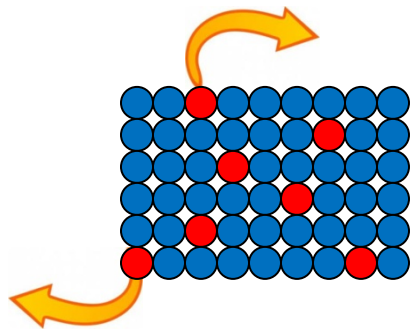
- 2006 EU Directive bans specific families of Brominated FR's
- Voluntary ban of **all** Bromine FR by the major consumer electronic OEMS by specific dates



NOFIA Polyphosphonates, A Unique FR Solution

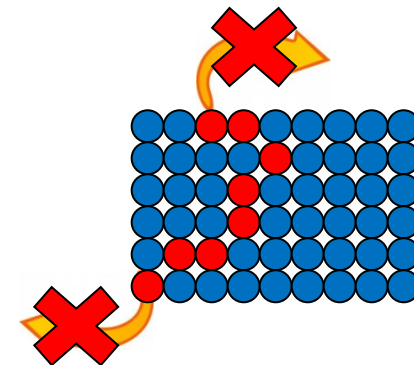
nofia®

- Unique. First of its kind
- Highly patented
- Sustainable
- Environmentally friendly
- **Non-Migrating**



*Plastic with
current FR
additives*

Small molecules end up in environment



*Plastic with
NOFIA FR*

Large molecules trapped in plastic

Profile for Nofia HM1100 and Nofia OL1001

Human Health		Ecotoxicity	Environmental Fate		Physical
AT	G/M	AA	P	B	F
L	L	L	H*	L	L

AT – Acute Mammalian Toxicity

- Acute Oral Toxicity (Rats)
- 28-day Repeat Dose Oral Toxicity (Rats)

G/M - Genotoxicity/Mutagenicity

- Ames Test
- Chromosome Aberration Test

F – Flammability

AA - Acute Aquatic Toxicity

Algae, Daphnia, Fish

P - Persistence (Biodegradability, water)

B - Bioaccumulation (Bioconcentration Factor (BCF), Fish)

* Rating for All Non-Biodegradable Polymers

Barriers & Opportunities for Green Chemicals

Barriers:

- Customer Skepticism
- Fit in selected application – must meet all requirements
- Must be cost competitive

Opportunities to Overcome Barriers:

- Development of complete data package – demonstration of product fit,
- Provide customers with starting formulation for their evaluations,
- Ensure that cost competitiveness is “built-in” to R&D efforts up front – avoid it being an after thought,
- Legislation

FRX Case Studies

Migration:

- Key competitive advantage for Nofia

Textiles / Carpeting:

- Migration - key issue with customers & NGO's
- Nofia solves this issue in all applications, a recent example
- Studies show high levels of brominated FR additives in pets and small children,
- Has led to legislation in California aimed at limiting the use of all FR additives – Boiling water to Frying pan syndrome

➤ FRX has demonstrated that there is no need to compromise between fire safety and chemical exposure.

FRX Case Studies

BioPolymers:

- Important new materials – ambitions to grow in all markets
- Pull from some key OEM's
- FR and overall properties – key success factor for Hard Goods

Hard Goods:

- Application requirements: Bio Content, mechanical properties, Heat Properties, Rheological Properties, FR Properties
- How to achieve without trade offs?

- Nofia provided a unique solution due to its polymeric nature,
- Delivered FR properties while boosting all other properties exposure.

pinfa

Phosphorus, Inorganic & Nitrogen Flame Retardants Association



Marc Lebel – Pinfa NA Chairman / CEO FRX Polymers

May 10, 2013





Who is pinfa?

- pinfa, the Phosphorus, Inorganic and Nitrogen Flame Retardants Association represents manufacturers and users of the three major technologies of non-halogenated flame retardants
- pinfa was established in 2009 as a Sector Group within Cefic, the European Chemical Industry Council
- expanded to NA as stand-alone, but connected organization in 2011
- It counts 23 companies all working in the FR plastics supply chain



Vision

- pinfa members share the vision of continuously improving the environmental and health profile of flame retardant products and offering innovative solutions for sustainable fire safety
- pinfa members share the common concept of an ideal flame retardant
 - Non-toxic
 - Non migrating
 - Non toxic and non corrosive gases in case of fire
 - Recycleable
 - Bio degradable or remains neutral as naturally occurring substances

Mission



- Promote the use of **PIN** FRs (**P**hosphorus, **I**norganic & **N**itrogen Flame Retardants)
- Provide information to users, legislators and other interested parties on safety, health and environmental issues related to PIN FRs
- Work with industry partners, associations and other stakeholders to support the safety and sustainability of PIN FRs
- Carry out research relevant to safety and sustainability

pinfa NA-Current Members



HUBER ENGINEERED MATERIALS



**NETWORK
POLYMERS™**

SOLID FLEXIBILITY



APPLIED MINERALS





Pinfa EU-Members in 2011

