FRX Polymers
Nofia® Polyphosphonates

Presented by Maggie Baumann 6-15-2021
Phone: 908-832-2207
mbaumann@frxpolymers.com

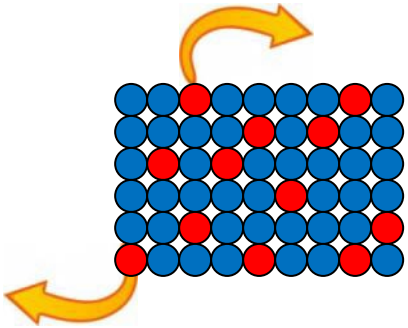
FRX Polymers is the producer and marketer of Nofia® Polyphosphonates, a unique non halogenated flame retardant additive

Margaret Baumann
NA Business Manager
FRX Polymers
mbaumann@frxpolymers.com

pinfa North America
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

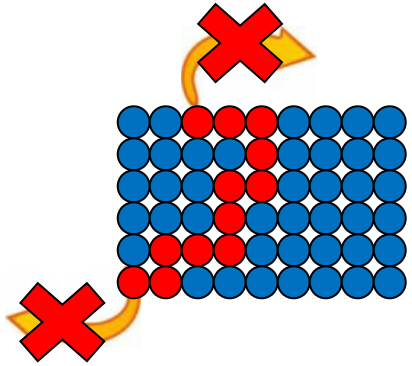
FRX POLYMERS

NOFIA Polyphosphonates, A Unique FR Solution



Plastic with current FR additives

Small molecules can end up in environment



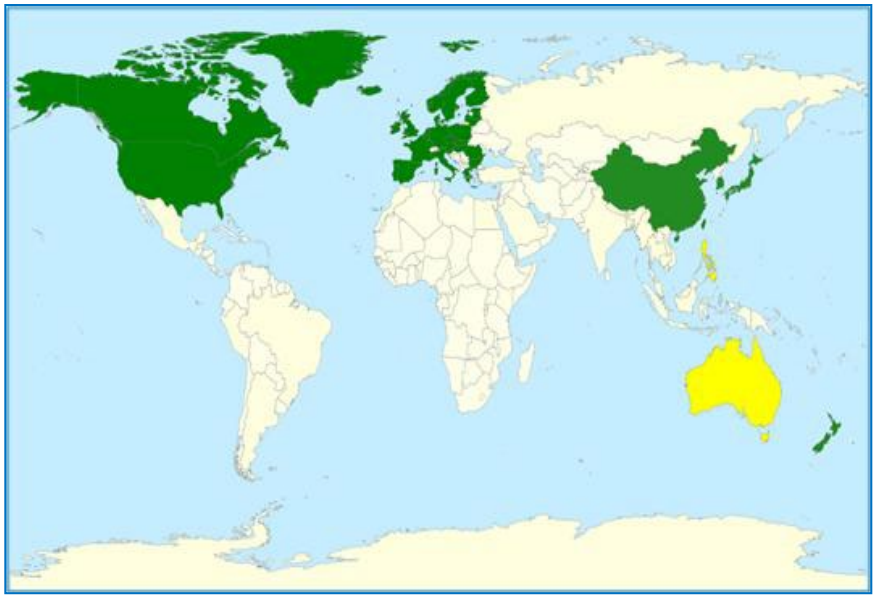
Plastic with NOFIA FR

Large molecules trapped in plastic

- Polymer:
  - **Permanent** and will not migrate out
  - **Minimal impact on host plastic** properties
  - Possible to use **plastic processing methods**
- Non-halogen flame retardant
- **High melt flow**
- **Transparent**
- Range of toughness

Nofia Phosphonates - Sustainable FRs

- NOFIA polyphosphonates are globally registered.
- All monomers are registered under REACH (production facility is in Europe)
- NOFIA polyphosphonates have favorable health profile and obtained a Benchmark Score of 3 in the GreenScreen assessment
- Recognized by the EPA as one of the alternatives for DecaBDE



Polyphosphonate was assigned a **Benchmark Score of 3** based on very high persistence. Data gaps (DG) exist for single dose systemic toxicity (ST-single), single dose neurotoxicity (N-single), and respiratory sensitization (SnR). Polyphosphonate meets requirements for a GreenScreen® Benchmark Score of 3 despite the hazard data gaps. In a worst-case scenario, if Polyphosphonate were assigned a high score for respiratory sensitization or a very high score for either single dose systemic toxicity or single dose neurotoxicity it would be categorized as a Benchmark 1 Chemical.

Green Screen Hazard Ratings: [*Polyphosphonate*]

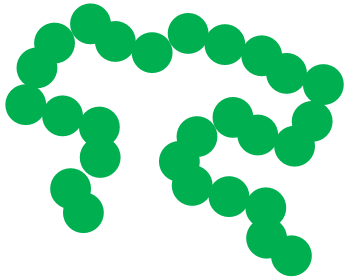
Group I Human					Group II and II* Human									Ecotox		Fate		Physical	
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
						single	repeated	single	repeated										
L	*L*	*L*	*L*	*L*	L	DG	*L**	DG	*L*	*L*	DG	*L*	*L*	*L*	*L*	*vH*	*vL*	*L*	L

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated values, authoritative B lists, screening lists, weak analogues, and lower confidence. Hazard levels in **BOLD** font are used with good quality data, authoritative A lists, or strong analogues. Group II Human Health endpoints differ from Group II* Human Health endpoints in that they have four hazard scores (i.e., vH, H, M and L) instead of three (i.e., H, M and L), and are based on single exposures instead of repeated exposures.

*While DfE assigned a moderate score for repeat dose toxicity due to possibility of lung overloading as a result of dust forming operations, it has been concluded that this is not a likely exposure scenario based on identified uses and therefore has not been included in the GreenScreen assessment.

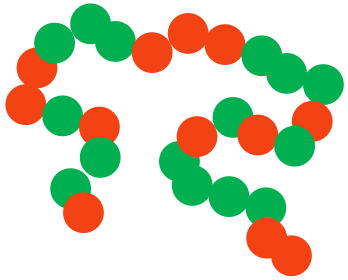
FRX Polymers' Products - Characteristics

Nofia Homopolymer



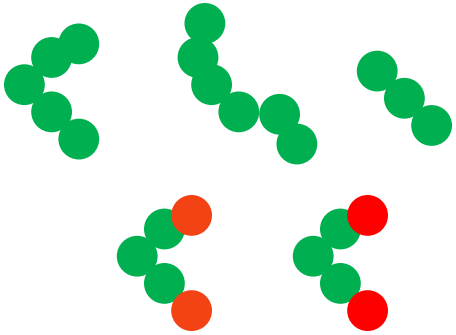
- Polyphosphonate (P ~ 11wt%)
- High molecular weight (40-100,000 g/mole, PS)
- Tg ~ 100-105°C
- Plastic pellets
- Typically used as blend component in plastics

Nofia Copolymers



- Polyphosphonate-co-carbonate (P ~ 3-7 wt%)
- High molecular weight (40-100,000 g/mole, PS)
- Tg ~ 120-135°C
- Plastic pellets
- Used as stand alone polymer or blend component in plastics

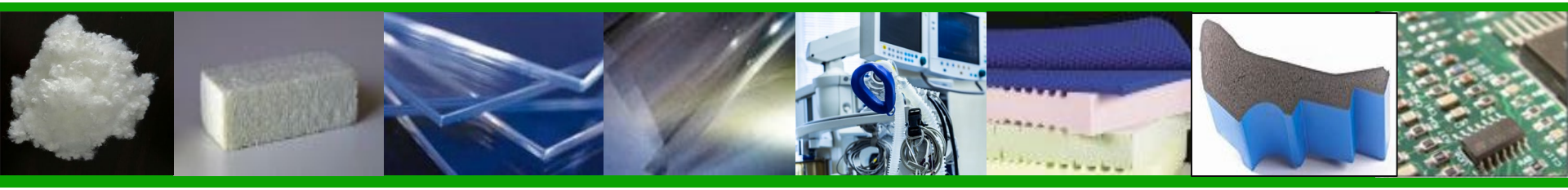
Nofia Oligomers



- Phosphonate oligomers
- Tailored end groups
- Low molecular weight (1,000 – 6,000 g/mole)
- 35 - 70 mg KOH/g
- Solid white material
- Used as reactive ingredient in thermoset applications

Tip – Polyphosphonates “sweet spot”

- **Thermoplastic Polyesters**
  - PET including recycle
    - Fiber, film, foam, molding
  - PC and PC blends- retention/ enhancement of properties
  - PBT (with co- FRs and synergists)
- **Thermosets**
  - PU- foams and coatings
  - Epoxy- composites and laminates
- **Beneficial to other polymer systems with Co-FRs and synergists**



Nofia is a Polymeric Non Hal FR

FRX Polymers' Global Presence

2013
Antwerp, BE
Commercial Plant

Chelmsford, MA
HQ, R&D

- **HQ, R&D**
- Production
- Sales Agents, Distributors
- Investors

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