FRX Polymers

Enabling the next generation of Flame Retardant plastics applications globally with Nofia

Dr. Ulrich Girrbach
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Extensively Experienced Management Team balanced between Fortune 100 + Start Up

**Management**

**Marc-Andre Lebel**  
President & CEO

**Christopher Joyce**  
VP Finance & CFO

**Dr. Ulrich Girrbach**  
VP Fibers & Textiles

**Kevin Trudel**  
VP Sales

**Dr. JP Lens**  
VP Research & Applications

**Dr. Frank Nuyttens**  
Manufacturing Manager
Since plastics are based on oil they burn readily and quickly. To make them safer, flame retardant (FR) materials are added. However, existing FR additives are toxic and will leach, discolour and degrade the host plastic. The market is looking for more environmentally friendly alternatives.

FRX has developed Nofia, the world’s first “polymeric” halogen-free flame retardant solution disrupting the US$30B+ global FR plastics & additive market.
FRX Polymers’ Global Footprint

The company is headquartered in the US and is supported by a global sales network of distributors.
Nofia...The Clear Solution Next Generation FR

Nofia represents the next generation of flame retardant non-halogen polymer technology.

Advances in Development

- High Growth in Plastics
- Many new applications
  - No health concerns
- Halogens, Suspected carcinogens
  - Dioxins when burned
  - Focused scrutiny begins
- Halogen
  - Toxic
  - Heavy
  - Bioaccumulative
  - Persistent in the environment
  - Global phase out begins
  - Products with Halogen increasingly banned in Europe

Today
- Non-halogen (safe)
- Polymeric (safe): Permanent will not leach out in environment
- Excellent FR properties
- Minimal impact on host plastic properties
- High melt flow
- Transparent
- Range of toughness
- Cost effective
- Non interfering electrical properties

Future...
Flame Retardants Need To Be Sustainable

✓ Halogen Free
• Persistent
• Bio Accumulation
• Toxic in to humans
• Continuous pressure from NGOs on OEMs

✓ Polymeric FR Solutions
• Non-migrating / low fogging
• Widely perceived as safest FR approach (customers & regulatory bodies)
• Bromine FR suppliers now offering polymeric forms of Bromine
• Due to Polymeric nature – more than just an FR additive
• Nofia is the only halogen-free Polymeric FR additive available today
# Flame Retardant Types

Nofia’s unique properties deem it far superior to many existing FR products.

## Polymeric

<table>
<thead>
<tr>
<th>Halogenated FRs</th>
<th>Phosphor Based FRs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brominated polymers</strong></td>
<td><strong>Polyphosphonates</strong></td>
</tr>
<tr>
<td>✓ No migration from host plastic</td>
<td>✓ Halogen free</td>
</tr>
<tr>
<td>× Use antimony trioxide as synergist</td>
<td>✓ Does not migrate</td>
</tr>
<tr>
<td>× Dioxins &amp; furans formed on incomplete incineration</td>
<td>✓ Favorable toxicity profile</td>
</tr>
</tbody>
</table>

## Small Molecules

<table>
<thead>
<tr>
<th>Halogenated FRs</th>
<th>Phosphor Based FRs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PBES, PBDES, TBBPA, decaBDE, HBCD</strong></td>
<td><strong>Phosphates, phosphinate salts, DOPO</strong></td>
</tr>
<tr>
<td>× Persistent, Bioaccumulate, Toxic</td>
<td>✓ Halogen free</td>
</tr>
<tr>
<td>× Use antimony trioxide as synergist</td>
<td>× Migration from host plastic</td>
</tr>
<tr>
<td>× Migrate from host plastic</td>
<td>× FR properties lost over time</td>
</tr>
<tr>
<td>× Dioxins &amp; furans formed on incomplete incineration</td>
<td>× Toxicity concerns (diphosphates)</td>
</tr>
<tr>
<td>✓ Favorable toxicity profile</td>
<td>× May negatively affect properties of host plastic</td>
</tr>
<tr>
<td>✓ Does not bioaccumulate</td>
<td>✓ Melt processable and transparent</td>
</tr>
<tr>
<td>✓ Enabling properties beyond FR</td>
<td>✓ Does not bioaccumulate</td>
</tr>
</tbody>
</table>

*Company Confidential*
NOFIA Polyphosphonates

Nofia Polyphosphonates provide a unique halogen-free permanent FR solution to manufacturers.

Competition

Non-Polymeric FR Additives

Polymeric FR Additives

Small molecules leach out, end up in environment

Plastic with current FR additives

Large molecules trapped in plastic will not end up in environment

Plastic with NOFIA FR
Nofia Phosphonates - Sustainable FRs

- 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 FR alternatives for DecaBDE.
- NOFIA polyphosphonates are registered in almost all countries that have a polymer exemption process (Australia pending).
- All monomers are registered under REACH (production facility is in Europe).
Flexibility In The Use Of Sustainable Feedstock

- Improved quality versus current products → color, mechanicals (tenacity)
- No need for special FR PET
- Can use multiple PET sources
  - Regular PET
  - Recycled PET
- Options to add FR to biobased polyesters
  - PLA containing polyester blends (Natureworks)
  - PTT (Sorona®, DuPont)
  - Polyethylene furanoate (Avantium)
Environmental and Quality Credentials
FRX Snapshot

FRX is pursuing multiple growth initiatives in 2017 and is supported by a strong investor base of both cleantech funds and potential customers.

Maturing product development and defensible product offering

- Nofia – a unique fire retardant platform technology, protected by a global patent estate of 194 patents across 27 patent families

Securing of production and supply chain

- Commercial plant in Antwerp, establishment of critical raw material supply chain, and development of a global distribution network

Experienced management & advisors

- Seasoned team with experience in Fortune 100 and start-up materials companies

Tier 1 investor base

- Major shareholders include multiple high-profile cleantech venture capital funds and end users

Over 300 sales development projects in pipeline

- Focused on 8 key segments and positioned to capitalise on the pipeline of customer projects

Expansion plans strongly focused on Asia

- 22 commercial customers globally of which 8 are located in Asia and 4 in China

Top 10 Shareholders

<table>
<thead>
<tr>
<th>Shareholder</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMV-TINA Comm. VA</td>
<td>13.3</td>
</tr>
<tr>
<td>Capricorn Cleantech Fund</td>
<td>13.1</td>
</tr>
<tr>
<td>Mubadala</td>
<td>9.5</td>
</tr>
<tr>
<td>Citic Capital</td>
<td>8.8</td>
</tr>
<tr>
<td>Israel Cleantech Ventures</td>
<td>8.2</td>
</tr>
<tr>
<td>Triton Systems</td>
<td>7.3</td>
</tr>
<tr>
<td>RobecoSAM Clean Tech Funds</td>
<td>6.8</td>
</tr>
<tr>
<td>Evonik Venture Capital</td>
<td>3.9</td>
</tr>
<tr>
<td>BASF Venture Capital Fund</td>
<td>3.3</td>
</tr>
<tr>
<td>Quest for Growth</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Total Shareholding</strong></td>
<td><strong>76.8</strong></td>
</tr>
</tbody>
</table>
**Market Structure & Nofia Opportunity**

**Commercial Applications**
- Electronics (50%)
- Transport (25%)
- Building (12.5%)
- Textiles (12.5%)

**Plastics and polymers**
- US$1T

**Flame Retardant Additives**
- US$30B

**Flame Retardant Additives**
- US$8B

**Tier 1 Dominated**

**Incumbents**
- BASF
- Dow
- DuPont
- Covestro
- SABIC

**Disrupter**
- FRX Polymers

- Delivers more than just FR
- Non-Toxic
- Polymerised: Strong
- Light
- Cheaper
- 9 grades of polymer

- **Halogen-based**: Toxic
- Small molecule, non-polymer: Weaker structure, brittle, heavy
- Expensive
# Attractive Immediate Market Opportunities

## Applications

<table>
<thead>
<tr>
<th>Printed Circuit Board</th>
<th>FR Textiles</th>
<th>Epoxy Coatings</th>
<th>Foams</th>
<th>Films</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphones</td>
<td>Curtains</td>
<td>Power grid</td>
<td>Automotive</td>
<td>Labels</td>
</tr>
<tr>
<td>Tablets</td>
<td>Wall coverings</td>
<td>Motors</td>
<td>Seating</td>
<td>Heat ducting</td>
</tr>
<tr>
<td>Laptops</td>
<td>Furniture</td>
<td></td>
<td>Structural panels</td>
<td>Shrink wrap</td>
</tr>
<tr>
<td>Servers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Nofia Enables

- Miniturisation
- Higher speeds
- Reduced power consumption
- New higher performance textiles
- High performance insulators for power grid applications
- Durability of under-the-hood foam products
- Encapsulation of solar panels
- Transparent tie-layers

## Commercial Partners

- World’s largest CCL producer (China)
- World’s largest PET fiber producer (India)
- Leading Chinese epoxy coating manufacturer
- World’s largest chemical company (Global)
- World’s largest BOPET film producer (Global)

## Addressable Market (US$)

- $1.2b
- $150m
- $150m
- $700m
- $500m
## Added Verticals Ensure Sustained Growth

### Applications
- Aviation cabins
- High speed trains
- Longer escape time from burning cabin
- Eliminates exposure to chemicals
- Tablets
- Laptops
- FR
- High strength
- Only environment friendly FR solution
- Consumer electronics
- Metal replacement in aviation & high speed trains
- FR
- Lightweight
- High heat resistance

### Nofia Enables
- Leading thermoformable sheet producer (Japan)
- Leading composite sheet producer (Global)
- Leading FR co-supplier (Global)
- Leading FR co-supplier (Global)
- Leading resin producer (Global)

### Commercial Partners
- Leading thermoformable sheet producer (Japan)
- Leading composite sheet producer (Global)
- Leading FR co-supplier (Global)
- Leading FR co-supplier (Global)
- Leading resin producer (Global)

### Addressable Market (US$)
- $500M
- $200M
- $1B
- $100M
- $500M
Awards and Recognition

2009
- Featured on The Economic Report – CNN and FOX
- Winner of Society of Plastics Engineers Clean Technology Forum Business Plan Competition
- Featured on CNN Money

2012
- Global Going Green Top 200 Companies
- Global CleanTech Top 100 Companies

2013
- Frost and Sullivan “Product Innovation of the Year Award”
- Flanders “Foreign Investment of the Year” award (aired on “Kanaal Z” in Belgium)

2014
- Global CleanTech Top 100 Companies
- Global CleanTech “Lust List” Top 3
- Environmental Merit Award – United States Environmental Protection Agency

2015
- Global CleanTech Top 100 Companies

2016
- Frost and Sullivan “Product Innovation of the Year Award”
- Belgium Business Award for the Environmental
- Flanders CleanTech Internationalization Award for Sustainability Leadership