FLAME RETARDANT

ECOPIRE
MAKES OUR WORLD PURE AND SAFE
COMPANY PROFILE

ECOPIREN® is an ecological and economic flame retardant which is used in a wide range of applications. For our customers’ successful application and use of this product the following companies have joined forces:

RUSSIAN MINING CHEMICAL COMPANY (RMCC)
Founded in 2002, RMCC is a mining and producing company with head office in Moscow. RMCC has recently installed state of the art production facilities in Vyazma (200 km west of Moscow) and has mining facilities in Kuldur, Eastern Russia. RMCC is completing installation and implementation of advanced sorting technology at the mining site and new micro-nizing capability is already in place in Vyazma. Quality is taken very seriously throughout the company and both in Kuldur and Vyazma XRF analyses are part of the production control.

VAN MANNEKUS & CO BV (VMC)
In the European, American and Asian markets RMCC closely cooperates with the Dutch company Van Mannekus & Co (VMC), our exclusive distributor for these regions. VMC was founded in 1904 and is a leading processor and supplier of high grade magnesia to the rubber and plastics industry. VMC is located right in the heart of the busy Rotterdam port area. This unique logistical position and streamlined distribution enable delivery of the products just in time and ready for use. VMC works closely together with the fully equipped R&D centre of its shareholder Grecian Magnesite for research projects as well as customer specific test programs.

FLAME RETARDANTS ASSOCIATES, INC. (FRA)
USA-based FRA provides our group of companies as well as our customers specific consultation, technical formulation and compounding expertise and knowledgeable assistance with global flammability standards. FRA has extensive long-term technical experience in the flame retardant industry and has worked worldwide with numerous users of metal hydrate flame retardant products as well as many academic and governmental research centers.
QUALITY CONTROL AND ENVIRONMENT

The group of companies work together to research and develop utility aspects of Ecopiren products and to control all the stages of production, from mining of raw material with assigned chemical composition to the shipment to the end-user.

THE PRODUCTION PROCESS INCLUDES:

- Selective ore mining at the deposit;
- Pre crushing;
- X-ray separation (beneficiation);
- Crushing and sieving;
- Quality control using state of the art equipment;
- Transportation to the plant;
- Incoming control at plant;
- Milling, classification and packing of the end-product;
- Outgoing control of the end-product;
- Delivery to the warehouse in Schiedam (Netherlands);
- Delivery of the end-product to a customer.

The modern equipment, which is operating in our plants, is environmentally friendly and complies with critical ecological standards.

The non-toxic flame retardant products which are produced by Russian Mining and distributed by Van Mannekus meet all ecological standards adopted in EU, America and Asia.

Halogen free, extremely low heavy metal content, no classified elements – only what Mother Nature gave us – magnesium and water. All polymers containing ECOPIREN® FR products are safe to handle and recyclable.
ECOPIREN® FR products have consistent characteristics: chemical composition, temperature of decomposition, particle size distribution, and quality of surface treatment.

ECOPIREN® FR products provide both effective flame retardant performance and smoke emission reduction/toxic gases absorption in various polymeric materials including HFFR and LS compositions.

ECOPIREN® FR products are manufactured in standard grades (3.5, 3.5 C, 5.5, 5.5C, 10, 15, 25) which have various particle size distributions and various types of surface treatments.

However, tailor-made ECOPIREN® FR products to specific customer requirements can be produced. ECOPIREN® FR products have the following typical properties and characteristics:

### ECOPIREN® FR PRODUCTS CHARACTERISTICS:

<table>
<thead>
<tr>
<th>Product name</th>
<th>Colour</th>
<th>D50</th>
<th>D90</th>
<th>Water content</th>
<th>Bulk weight</th>
<th>Surface treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecopiren 3,5</td>
<td>White</td>
<td>3.5-4.5</td>
<td>9-10</td>
<td>≤ 0.5%</td>
<td>400 g/l</td>
<td>No</td>
</tr>
<tr>
<td>Ecopiren 3,5C</td>
<td>White</td>
<td>3.5-4.5</td>
<td>9-10</td>
<td>≤ 0.5%</td>
<td>400 g/l</td>
<td>Stearic acid</td>
</tr>
<tr>
<td>Ecopiren 5,5</td>
<td>White</td>
<td>5.0-6.0</td>
<td>15-17</td>
<td>≤ 0.5%</td>
<td>500 g/l</td>
<td>No</td>
</tr>
<tr>
<td>Ecopiren 5,5C</td>
<td>White</td>
<td>5.0-6.0</td>
<td>15-17</td>
<td>≤ 0.5%</td>
<td>500 g/l</td>
<td>Stearic acid</td>
</tr>
<tr>
<td>Ecopiren 10</td>
<td>White</td>
<td>9-12</td>
<td>30-40</td>
<td>≤ 0.5%</td>
<td>950 g/l</td>
<td>No</td>
</tr>
<tr>
<td>Ecopiren 15</td>
<td>White</td>
<td>13-16</td>
<td>40-50</td>
<td>≤ 0.5%</td>
<td>1050 g/l</td>
<td>No</td>
</tr>
<tr>
<td>Ecopiren 25</td>
<td>White</td>
<td>20-30</td>
<td>80-90</td>
<td>≤ 0.5%</td>
<td>1150 g/l</td>
<td>No</td>
</tr>
</tbody>
</table>
Additionally all ECOPIREN® FR products may be characterized by specific effects upon being compounded in polymers:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Effect</th>
<th>Effect in compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precise and consistent particle size</td>
<td>Higher loading rates become possible</td>
<td>Higher fire resistance</td>
</tr>
<tr>
<td>Tableted particle form</td>
<td>Better distribution in polymer</td>
<td>Easy to compound</td>
</tr>
<tr>
<td>Excellent flow ability</td>
<td>Higher extrusion rates</td>
<td>Higher outputs</td>
</tr>
<tr>
<td>Consistent chemical composition</td>
<td>Dependable heat absorption</td>
<td>Effective fire resistance</td>
</tr>
<tr>
<td>High thermal stability</td>
<td>No blistering at high extrusion rates</td>
<td>No compound losses</td>
</tr>
<tr>
<td>Low water absorption at storage</td>
<td>No pore formation at compounding</td>
<td>Higher compound quality</td>
</tr>
<tr>
<td>Low content of electrolytes</td>
<td>Better electric performance</td>
<td>Higher insulating barrier</td>
</tr>
</tbody>
</table>

All ECOPIREN® FR products are cost effective and give compounders perfect economical advantages.
ECOPIREN FR PRODUCTS AT WORK

DECOMPOSITION EFFECTS AND THEIR INFLUENCE:

<table>
<thead>
<tr>
<th>Effect</th>
<th>Character</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High energy absorption</td>
<td>System cooling</td>
<td>Reduces temperature of substrate due to endothermic decomposition of the hydroxide</td>
</tr>
<tr>
<td>Water release</td>
<td>Gases dilution</td>
<td>Oxygen/burning gases mixture is diluted with inert water vapours</td>
</tr>
<tr>
<td>Ceramic “char” layer formation</td>
<td>Polymer protection</td>
<td>Thick and refractory ceramic layer insulates inner polymer from the burning surface</td>
</tr>
<tr>
<td></td>
<td>Energy deflection</td>
<td></td>
</tr>
</tbody>
</table>

All ECOPIREN® FR products decompose at 330°C. This process is accompanied with following effects:

\[
\text{Mg(OH)}_2 \rightarrow \text{MgO} + \text{H}_2\text{O}
\]
During compounding, all ECOPIREN® FR products have an influence on compound properties which in their turn help to meet even the most severe FR standards and requirements in the final polymer.

**COMPOUND PROPERTIES AND THEIR EFFECTS:**

<table>
<thead>
<tr>
<th>Ecopiren derived compound property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved fireproofing</td>
<td>Helps to meet fire and smoke standards</td>
</tr>
<tr>
<td>Improved heat aging</td>
<td>Helps to increase working time in aggressive environment</td>
</tr>
<tr>
<td>Excellent dispersion in polymer</td>
<td>Helps to achieve higher extrusion rates</td>
</tr>
<tr>
<td>Better rheology/viscosity (MFI)</td>
<td>Helps to meet process requirements</td>
</tr>
<tr>
<td>Synergism with ATH and antimony oxide</td>
<td>Gives higher flexibility in formulation technology</td>
</tr>
<tr>
<td>Lower conductivity</td>
<td>Reduces risks of cable failures (due to lower content of electrolytes)</td>
</tr>
</tbody>
</table>

Moreover, all ECOPIREN® FR products affect several specific compound properties and/or end-product performances. These influences may be found in the special application sections below.

ECOPIREN® FR products are ideally applicable in those industries where ATH was used for many years. ECOPIREN® FR products can not only replace traditional ATH but also give cost advantages to compounders.

Normally, replacing ATH with ECOPIREN® FR products, the compounder makes a 20% to 50% cost saving.

Even though cutting the costs in itself attractive, ECOPIREN® FR products also have a higher decomposition temperature. Therefore a higher temperature during compounding and extrusion is possible giving a higher production rate. This gives the Ecopiren user more flexible processing. Also the use of ECOPIREN® FR products provides recyclable, environmentally friendly end-products.
ECOPIREN FR PRODUCTS, APPLICATIONS

HALOGEN FREE FLAME RETARDANT (HFFR) SHEATHING AND INSULATION CABLE COMPOUNDS:
The ecological standards have become more and more stringent during last years. Now, in some cases PVC can’t be used because of the chlorine content, so HFFR compounds must be used instead. HFFR compounds, due to their flexibility and low crystallinity, use varying amounts of ECOPIREN® FR products and produce a wide range of composite materials for a diverse spectrum of end-use applications.

HFFR BEDDING/FILLING CABLE COMPOUNDS
Along with the sheathing upper layer HFFR cables contain a so called “bedding layer” which takes up most of cable’s inner space. It is produced of special HFFR compound that protects wire itself and helps cable to retain its form. These compounds should be extremely fireproof and, therefore need to be highly flame retardant.

ALUMINUM COMPOSITE PANEL HFFR COMPOUNDS
Aluminum composite panels consisting of two aluminum cover sheets and a mineral filled polymer core find wide application in the building industry when whole new architectural approaches are required. Public buildings, business offices, malls and industrial complexes need this brand new and attractive product for façade works.
PVC CABLE COMPOUNDS
Today, PVC is the most used polymer worldwide. Of course, PVC is already fireproof but since it is used mostly in plasticized compositions, it is necessary to add flame retardants to improve the fire resistance. An example is in low voltaic cable applications and wire insulations. All Ecopiren FR products are perfectly compatible with PVC.

TPO ROOFING MEMBRANES:
TPO-based products have been used in various applications for many years and continue to expand day by day. The most popular application is TPO roofing membranes. This product is typically based on polypropylene and EP (ethylene-propylene) rubber polymerized together using specialized polymer manufacturing technology.

PVC FLOORING COMPOUNDS
( SOFT FLOORS)
Another major application of PVC is plasticized soft floors. They can be found in a variety of buildings around the world. Because these floors are mostly used in places with a large accumulation of people, they are subject to stringent fire standards.

OTHER APPLICATIONS
There are many, many applications which require flame retardants where ECOPIREN® FR products are being successfully used. For more information on these applications, please look through our technical application leaflets.
RESEARCH & DEVELOPMENT

The group of companies place special emphasis on the research and development process. We have our own modern equipped R&D center with highly knowledgeable and experienced staff. This center works on the characteristics of our product and performs quality control. Using contemporary and innovative equipment helps us to consistently produce required technical data on our products. We are committed to the environment and for that reason we have very strict control of chlorine and heavy metals content using XRF analysis at our laboratory.

A close cooperation with our partner’s (Grecian Magnesite) R&D center also provides application programs, product support and technical assistance.
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