What is Kanecaron/Protex?
Kanecaron/Protex is a modacrylic fiber developed by Kaneka.

Kanecaron®
Kanecaron is a functional fiber that possesses the characteristic of high flame retardancy (FR) as well as acrylic fiber’s natural attributes of softness and dyeability. It is an inherently self-extinguishing FR fiber that imparts excellent flame-retardancy to fabrics and synthetic fibers.

Protex®
Protex is the advanced FR fiber in the Kanecaron family. Its advanced FR and heat resistance, upon blending, improves FR performance in flammable fibers like cotton or polyester.

**Modacrylic**
The generic name of a fiber that has a lower acrylonitrile (35-85%) level than ordinary acrylic fiber in its make up.

**Self extinguish**
No flame spread and the ability to stop combustion when the flame source is removed. Kanecaron/Protex will create a char that works to prevent the flame without melting.

**Inherent FR fiber**
Polymerized FR fiber that does not require topical FR treatments.
Inherently Flame Retardant

Kanecaron / Protex is an inherently flame retardant product in which the fiber resin itself contains the flame retardant ingredient. When the flame source is removed Protex has a self-extinguishing nature by which combustion stops immediately. Unlike FR treatments, there is no deterioration in flame retardancy after repeated washing or normal use over time.

Limiting Oxygen Index (LOI)

In conformity with JIS L 1091

Kanecaron/Protex exhibits a high LOI figure in comparison to other fibers.

<table>
<thead>
<tr>
<th>Fiber</th>
<th>LOI value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>LOI/17-19</td>
</tr>
<tr>
<td>Rayon</td>
<td>LOI/17-19</td>
</tr>
<tr>
<td>Acrylic</td>
<td>LOI/18-20</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>LOI/18-20</td>
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<tr>
<td>Polyester</td>
<td>LOI/20-22</td>
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<tr>
<td>Nylon</td>
<td>LOI/20-22</td>
</tr>
<tr>
<td>Wool</td>
<td>LOI/24-26</td>
</tr>
<tr>
<td>Kanecaron SB</td>
<td>LOI/28</td>
</tr>
<tr>
<td>Protex-M</td>
<td>LOI/33</td>
</tr>
</tbody>
</table>

Note: the above are test results conducted by Kaneka Corporation and are not guaranteed.

Self-extinguishing

Self-extinguishes when flame source is removed.

In the case of flammable fabric, fire spreads very quickly when ignited. Kanecaron/Protex blended fabric will self-extinguish and will form a char barrier that works as a shield to minimize fire damage.

45° micro burner method:

The combustion test due to JAPAN FIRE RETARDANT ASSOCIATION

Self-extinguishes when flame source is removed.

Fire spreads even after flame source is removed.

30 seconds after flame source is removed.

The Mechanism of FR

Protex reacts to flame and high heat radiation instantly, providing protection with its special FR mechanism of self-extinguishing and thermal cooling.

Phase 1: Reaction

External factor: Flame source

Start of thermal reaction by FR properties

Phase 2: Reaction

Heat/Flame/Pressure Blast

Heat/Flame/Pressure Blast

FR properties disperse the heat, evaporating and carbonizing against the heat to self-extinguish.

Phase 3: Reaction

Self Extinguishing with carbonized barrier

Heat/Flame/Pressure Blast

Self Extinguishing with carbonized barrier

High level protection is created by its self-formed carbon barrier that cools and extinguishes.
Melt-resistant  (Carbonization)

Kanecaron/Protex stops the spread of the fire and extinguishes it with the char barrier it forms when the flame source is removed. Unlike other thermoplastic fibers, such as polyester, Kanecaron/Protex does not melt or form droplets that could stick to skin and cause injury.

No molten droplet  Melt/Drip Resistance

When thermoplastic fibers, such as polyester and nylon, melt they produce hazardous high temperature droplets that could cause severe burns to the skin.

Kanecaron/Protex melt-resistance and carbonization attributes not only extinguish the fire, but also play an important role in preventing secondary injuries.

Prevention of dripping

Note: The effectiveness of melt/drip prevention varies depending on the type and ratio of raw cotton used.

Kanecaron/Protex for non-woven fabrics;  FR-Melt/Drip Resistance: Combustion Analysis

Plastic material devices for instrument parts;  UL 94 Standard

**Exam method**
The specimen is held perpendicular to the table above the gas burner with the bottom end in contact with the flame. If the fire diminishes in less than 3 seconds the specimen is kept in contact with the flame for additional 10 seconds.

**Criterion**

<table>
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<tr>
<th>Result</th>
<th>After Flame</th>
<th>Burning Drip</th>
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<tr>
<td>V-0</td>
<td>≤10sec</td>
<td>0</td>
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<tr>
<td>V-1</td>
<td>≤30sec</td>
<td>0</td>
</tr>
<tr>
<td>V-2</td>
<td>≤30sec</td>
<td>Permissible</td>
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</table>

**Result**
Sample 1  Protex/FR-Rayon/Polyester
The non-woven fabric carbonized immediately after the flame source was removed and did not drip.
Conforms to V-0
Sample 2  FR-Rayon/Polyester
The non-woven fabric continued to burn and drip after the flame source was removed.
Non-conforming

**Exam method**
The specimen is held perpendicularly in contact with the flame for 15 seconds. The speed of combustion is observed.

**Criterion**

<table>
<thead>
<tr>
<th>non self-extinguishing</th>
<th>combustion-speed (between rectangles) ≤ 100mm/min</th>
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</thead>
<tbody>
<tr>
<td>self-extinguishing</td>
<td>combustion-distance ≤ 50mm, furthermore combustion-time ≤ 60sec</td>
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</tbody>
</table>

**Result**
Sample 1  Protex/Polyester 10%/90%
Sample 2  Polyester 100%
Sample 3  FR-Rayon/Polyester 10%/90%
Combustion or melting was not observed in specimens mixed with Kanecaron/Protex.

**Summary - Combustion Analysis and FR standards**
The use of Kanecaron/Protex allows for creational products to meet various FR standards around the world.

- Please consult us for a specific formula to meet each FR standard.
- For more information on many international FR standards Kanecaron/Protex has satisfied, please refer to page 13
Highly Blendable

The superior properties of Kanecaron/Protex allow for blending with flammable fibers in various combinations to achieve a high level of FR performance.

**Blendability / Adaptation of cellulosic fiber**
Protex-M blended with cellulosic fibers such as cotton and rayon, increases the overall FR performance.

The graph on the right shows the LOI values of cotton fiber mixed in 3 blends (Protex-M, meta-aramid, FR rayon) at various ratios.

Protex-M with its outstanding flame retardancy allows for higher blend ratios with cotton. The resulting cellulosic blend fabric is well suited for use in both ordinary and industrial environments.

**Blendability / Compound functionality**
When blended Protex-M has the capacity to add flame retardancy to flammable fibers.

The graph on the right shows the LOI values of Protex-M fibers, each mixed with one of three flammable fibers: polyester, rayon, wool.

It utilizes the different merits of the Protex fiber, providing a multi-function FR fabric as shown below.
Easy Processing (Spinning, Dyeing, Molding)

Kanecaron/Protex can be blended with other fibers for intimate blending or in various fabric combinations. Cationic dyeing makes possible expressions of beautiful and long-lasting color shades. In most cases it can be processed under the same conditions as conventional acrylic fiber.

From raw material to product; easy processing Spinning

Kanecaron/Protex Process form

- Fiber
- Sliver
- Tow
- Spinning yarn
- Knitted
- Woven
- Nonwoven
- Filling
- Paper

Recommendation processing point
- 1. Temperature and humidity
   - Room temperature 20-25 deg C / Humidity 50-60% RH
   - The same condition of cotton, polyester, acrylic can be applied but a more gentle condition is preferred because Kanecaron-Protex fiber is easy to open.
   - Low tension will be required to have a better yarn quality. Regarding the ring type, a backed ring is the best to use in order to avoid the excessive friction caused by the transfer and tension control.
- 2. Opening and Carding
- 3. Drawing, spinning and rewinding

Beautiful hues with cationic dyeing Dyeing

Beautiful and long-lasting colors can be obtained with cationic dyes as with regular acrylic fibers.

With this
- High designability
- High contrast, high visibility color expressions made possible

Recommendation processing point
- In case of stock dyeing
- 1. The step-wise and low rise control in the temperature is required around 85 deg C due to the start of migration and quick absorption rate.
- 2. Dyeing temperature should be kept below 85 deg C as the fabric will start to shirk at 100 deg C or higher and the fiber will become stiff.
- 3. The amount of retarder should be reduced to avoid the delay of absorption of dyes. Carriers can be used for the deep shade, but a deoxidation process will be required after dyeing.

Stable molding with short processing time Molding

Kanecaron/Protex is suitable for molding. Its elasticity is at its highest when within the temperature range of 120 to 130 degrees Celsius. This allows for molding with a deep draw over 100% depth on the fabric.

Kanecaron/Protex keeps a molded shape without stress unlike other common fabrics such as knit or elastomeric yarn that will revert to the original shape after tension is removed.

Softening curve in thermo forming

- Measurement condition
  - Measurement range (Length): 30mm
  - Loading: 5mg/d
  - Temperature rising speed: 3°C/min

- Shrinkage (%)
- Kanecaron: 10% / 154°C MAX / 140°C
- Protex: 10% / 175°C MAX / 200°C

Fabrics and nonwoven made with Kanecaron/Protex can be thermoformed with a common plastic forming facility and under simple temperature management. It can be thermoformed either by itself or in combination with vinyl chloride, pp, polystyrene forms, polyethylene and other materials, and is often used in interiors of automobiles.
Soft and Light

Kanecaron/Protex is light, warm, soft and flexible due to its unique fiber form.

The properties created by its unique fiber form

In addition to being a functional fiber with special properties fit for industrial use, Kanecaron/Protex also possesses unique qualities that make it a perfect fit for a wide range of clothing and interior goods applications.

Such qualities are the result of combining modacrylic's attributes and Kanecaron/Protex's original fiber-form molding.

By combining with cotton and other cellulosic or natural fibers both functionality and comfort can be achieved.

Various processing methods can be applied to create different looks and textures. It excels especially in re-creating varieties of fur-like fabrics.
### List of Fiber Types

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<th>Protex</th>
<th>Oeko-tex</th>
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<td>Semi-dull</td>
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Note: The data provided is for reference purposes only and is not meant to be a guaranteed value.

### Additional Information

<table>
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<tr>
<th>TYPE</th>
<th>Dope-dyed Black</th>
<th>Dope-dyed Blue</th>
<th>Dope-dyed Gray</th>
<th>Dope-dyed Camel</th>
<th>High shrinkage</th>
<th>No crimp</th>
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</tr>
</tbody>
</table>

Note: The data provided is for reference purposes only and is not meant to be a guaranteed value.

Please contact us for the latest information.
Kanecaron Protex

Applications
Clothing

Protective clothing  Workwear  Hoods
Pinafores  Arm covers  Filling

Protex can even protect workers against arc flash.

**Arc Flash**

Arc flash can cause severe damage to the human body and in recent years has become the newest challenge to protective clothing.

Protecting the human body from potential injuries in dangerous industrial environments requires proper use of qualified protective clothing.

Timely self-extinguishment and thermal cooling by Kaneka's original FR mechanism.

The melt and drip resistant fabric forms carbon barrier.

The material's natural functions

High FR, and self-extinguishing ability, as well as resistance against chemicals, do not wear out or wash off over time.

Functionality and comfort

Protex can be mixed with other materials while maintaining its original function. Blending with cotton or cellulosic fibers in particular improves air-permeability and sweat absorbency for addition of comfort.

High quality and durability

Fabrics and clothing made with Kanecaron /Protex are durable and hold up to heavy and continuous use over time.

Protective function

- Fire, Spark
- Radiant heat
- Molten metal
- Explosion
- Chemicals
- Electric Arc

Protective gear is often regulated by strict and specific national or regional law to ensure safety.

Kanecaron/Protex will meet the demands of both daily safety and industrial FR regulations.
Battery material
It is used in electrodes of lead-acid batteries, alkali batteries, and parts of separators.

Automotive
Interior materials

Filters (Non Woven)
Kanecaron/Protex is often used in non woven air filters that demand high FR quality.
(Blended with polyester)

Its high FR and superior processability make Kanecaron/Protex a popular material for automotive interiors.

Kanecaron/Protex with its variety of unique attributes is adaptable to numerous industrial applications and has become an essential ingredient in many products.

In addition to its natural attributes, Kanecaron/Protex’s ability to impact its properties to blended products opens the door to a host of new industrial applications.
Drapery  Carpets  Partitions  Upholstery  Wall covering  Fabric blinds  Theater curtains and decorations

Self-extinguishing ability stops the fire from spreading.
Many large fires start small and spread onto curtains and sofas. Kanecaron/Protex lowers such possibility and minimizes the risk of greater damage.

High performance FR products.
Most countries and regions have highly specific and strict FR regulations for large facilities and tall residential buildings. Kanecaron/Protex has satisfied many of such regulations and is recognized internationally.

Kanecaron/Protex’s variety of raw materials and their processability allows for creation of beautiful textiles to embellish any styles of interior design, without compromising its high FR.

High performance, comfortable, and attractive Interior goods.

Self-extinguishes when flame-source is removed.

Method of exam BS5852 source 5.
Blankets  Throws  Duvet Cover  Comforters  Filling  Cushions  Mattresses  Bed pads  Bed sheets  Towels  Stuffed toy

With Kanecaron/Protex beddings and bed linens can be made flame-retardant.

Comfort
Best blended with cotton and other cellulose fibers

Innerwear and linens, frequently washed items

Warm and natural looks and textures of animal fur can be re-created with Kanecaron/Protex.

Kanecaron/Protex forms a carbon barrier to prevent the further spread of fire and ignition of the mattress interior.

Kanecaron/ProtexMattress Combustion test
Self-extinguished after flame-source is removed.
Method of exam CFR1633

Stuffed toys made safe by high flame-and-melt retardancy of Kanecaron/Protex

With Kanecaron/Protex an entire bedroom can be made flame retardant from the bedding, linens, to even pajamas.
Kanecaron® Protex®
Kanecaron · Protex and the world's FR standards.

Kanecaron/Protex has already satisfied numerous FR standards around the world.

In addition to FR application

Pile(Fur fabric)
The ability to recreate in fur fabrics the realistic shine and feel of animal fur is one of Kanecaron's unique advantages.

Hair extensions and wigs
Kanecaron is also used as a realistic alternative to human hair in making of hair extensions, wigs and doll hair.

Contact Info
Kaneka Corporation  Performance Fibers Solutions Vehicle
2-3-18, Nakanoshima, Kita-ku, Osaka 530-8288, Japan
Tel: +81-6-6226-5223  Fax: +81-6-6226-5239
E-mail: fr@kanecaron.com  URL: http://www.modacrylic.com
Kanecaron exhibits superior chemical resistance against acid, alkaline, organic and inorganic chemicals and is used commonly in industrial materials(*).

(*) Filters, workwear, battery material, etc.

Acid resistance, Alkali resistance : High retention ratio

<table>
<thead>
<tr>
<th>CHEMICALS</th>
<th>INORGANIC ACID</th>
<th>ORGANIC ACID</th>
<th>INORGANIC SALTS (in Aqueous Solutions)</th>
<th>MISCELLANEOUS ORGANIC CHEMICALS</th>
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<tbody>
<tr>
<td></td>
<td>Concentration (wt%)</td>
<td>Temperature (°C)</td>
<td>Shrinkage (%)</td>
<td>Retention of Strength (%)</td>
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<td></td>
<td>Perchloro ethylene</td>
<td>90</td>
<td>50</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Chloroform</td>
<td>100</td>
<td>22</td>
<td>-3.6</td>
</tr>
</tbody>
</table>

Note: The above are test results conducted by Kaneka Corporation and are not guaranteed.

The number of * indicates the level of color change.
Kaneka