ESTD. 1954

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मानव निर्मित और तकनीकी वस्त्र निर्यात संवर्धन परिषद
MANMADE AND TECHNICAL TEXTILES EXPORT PROMOTION COUNCIL

(Formerly SRTEPC)

High Performance Fibres: Applications & Advantages

Nandan Kumar (PhD)

HPT® HIGH PERFORMANCE TEXTILES PRIVATE LIMITED

ITT Institute of Technical Textiles

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TC-13899

HPT® HIGH PERFORMANCE TEXTILES PRIVATE LIMITED

ITT Institute of Technical Textiles

A yarn designing and manufacturing company based in India (Haryana);

HPT® yarns are designed to provide protection against thermal, mechanical and electrostatic hazards.

Product development centre:

- Materials (development & testing of high-performance fibres);
- Machines (development of testing machines);
- Manpower (training).

HPT Aracore®

HPT Cutpro®

HPT Anti-StaX®

Savesplash®

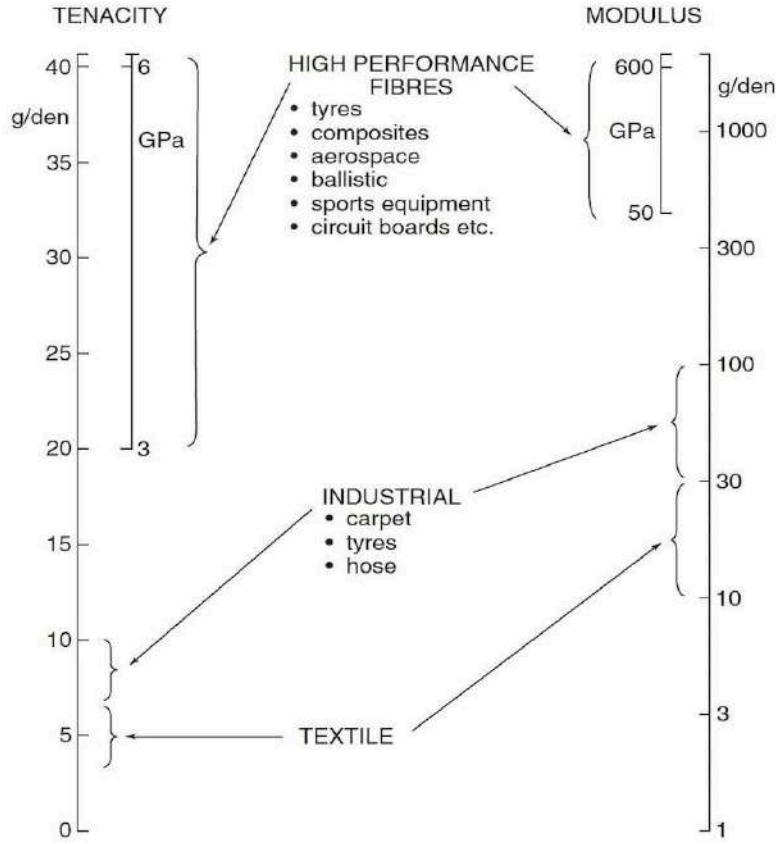
HPT Flex®

Introduction

- High performance fibers: at least one outstanding property, which conventional fibers do not have, e.g. high strength, high modulus, high chemical stability, high thermal stability or flame-retardant properties, antistatic, conductive;

- High-performance fibers are those that are engineered for specific uses that require exceptional strength, stiffness, heat resistance, or chemical resistance;

High performance fibres + conventional fibres



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Why Important ?

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Black dope para-aramid – 45-60 $/kg (virgin);
Black dope para-aramid – 35 $/kg (recycled);
Fibre dyed black para-aramid – 35-40 $/kg;

Yellow para-aramid – 25-35 $/kg (virgin);
Yellow para-aramid – 12-15 $/kg (recycled);
Green para-aramid – 38 USD $/kg;
(blend of yellow and black)

10-25% black nylon (6-8 USD per kg) ?
10-25% black modacrylic (8-10 USD per kg) ?
10-25% black FR viscose (10-12 USD per kg) ?

** Prices are approximate figure for discussion only*

Fibre	US$/kg
Polyester	3
High-modulus polymer fibres	
para-aramid	25
meta-aramid	20
HMPE	25
Vectran	47
Zylon (PBO)	130
Tensylon (SSPE)	22–70
Carbon	
PAN based	14–17
pitch based – general purpose	15
– highest modulus	2200
oxidised acrylic	10
Glass	3
E-glass	15
S-2 glass	
Ceramics	
SiC types: Nicalon NI, Tyranno Lox-M, ZM	1000–1100
near stoichiometric types	5000–10000
alumina types	200–1000
boron	1070
Thermally and chemically resistant fibres	
PEEK	100–200
thermoset: Basofil	16
Kynol	15–18
PBI	180
PTFE	50

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High Performance Fibres

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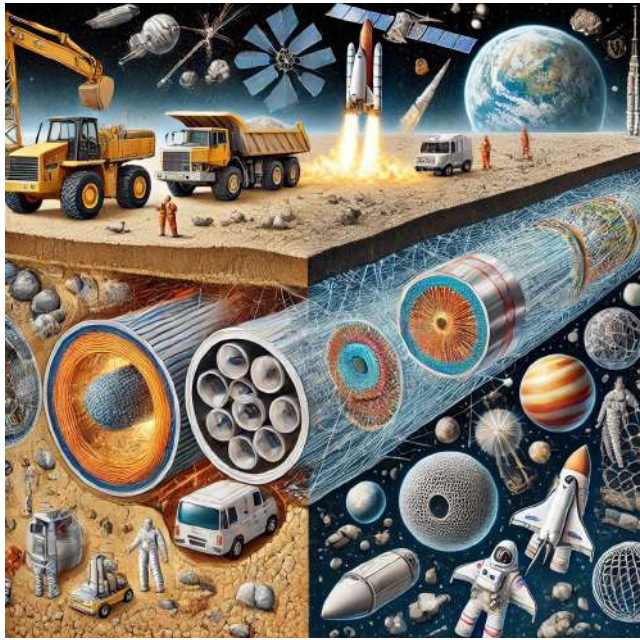
Inside & outside body

Inside & outside house



Inside & outside earth

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High Performance Fibres

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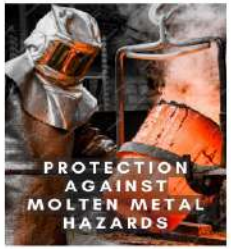

PROTECTIVE TEXTILES

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High Performance Fibres: Emerging Areas

Protection in extreme conditions

1. Protection against mechanical hazards
(abrasion, cut, tear, puncture, slash at higher and lower temperatures (+75°C to - 40°C);

2. Blending techniques: Fibres, Yarn, Fabric

- Bicomponent fibres or hard particles in fibres (nylon/polyester with carbon, UHMwPE with boron carbide, carbon, glass);
- Core-sheath yarns (Organic fibres next to skin & inorganic/metal fibres in core);
- Multilayered garments (knitted/woven next to skin with nonwoven inside);
- Recycled with virgin;
- FR treated with inherent;
- Natural with synthetic high-performance fibres (e.g. natural brown/green cotton with aramid, wool with aramid, hemp with UHMwPE).

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END PRODUCTS

- Flame-retardant workwear;
- Flame-retardant balaclava;
- Flame-retardant socks;
- Flame-retardant undergarments;
- Firefighter's suit;
- Proximity suit;
- Cut-resistant clothing;
- Cut & heat-resistant gloves & sleeves;
- Bite resistant clothing;
- Stab resistant clothing;
- Riot-control uniform;
- Bikers uniform;
- Sewing threads;
- Braided ropes/laces;
- Anti-vandal curtains;
- Full body harness;

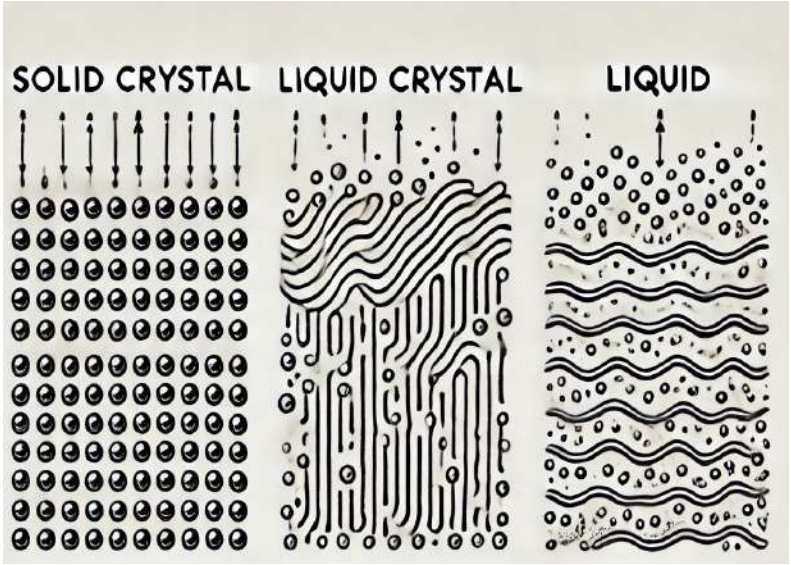
Liquid Crystalline Organic Fibres (LCs)

First predictions date back 1949 (by Onsager, Flory);

- Crystalline solids are ordered in 3D, whilst liquids are entirely disordered – LCs lie between these two extreme cases, i.e. they exhibit long range order in one or two dimensions, but not in all three dimensions;

The LC phase, or liquid crystalline phase (also known as the mesophase), is a state of matter that has properties between those of conventional liquids and solid crystals.

Liquid crystals are substances that exhibit this unique phase, showing anisotropic properties (direction-dependent) despite having a fluid nature.



Liquid Crystalline Organic Fibres (LCs)

LCs can be divided into thermotropic and lyotropic types:

Thermotropic liquid crystals – LC behaviour in certain temperature range;
Lyotropic liquid crystals – based on concentration of liquid crystal molecules in a solvent;

Fibres based on LCs can be divided into three classes:-

1. Aromatic polyamides (e.g. aramid);
2. Aromatic heterocycles, possess lyotropic behaviour (e.g. PBO, PBI) ;
3. Aromatic copolyesters, displays thermotropic behaviour (e.g. Vectran) ;

The outstanding mechanical properties of LC fibres can be reached only if polymers with high molecular weight are used

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Liquid Crystalline Aromatic Polyamide Fibres

Aromatic polyamides (commonly known as aramid fibres) – polyamides containing aromatic ring along the main chain;

- aliphatic polyamides: amide linkages (-CONH-) in the polymer backbone and having non-aromatic (aliphatic) hydrocarbon chains (no benzene ring); e.g. nylon 6, nylon 6,6;

- aromatic polyamides: amide linkages are attached directly to two main aromatic rings (benzene rings), e.g. phenylene rings or heterocyclic rings;

Why can't be melt spun ?

Aromatic polyamides decompose before a melting temperature, which is over 380-400°C for most of the polymers, so generally spun from polymer solutions, also, these are lyotropic LCPs since they form ordered mesophases in concentrated solutions.

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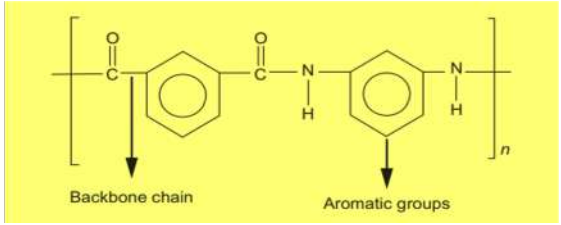
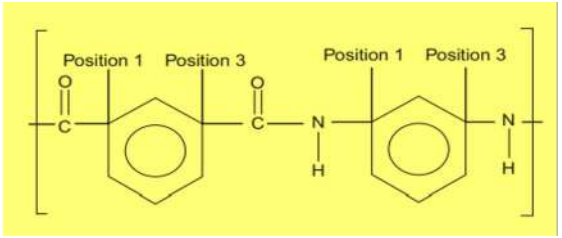
Liquid Crystalline Aromatic Polyamide Fibres: Inherent Flame-Retardant Fibres

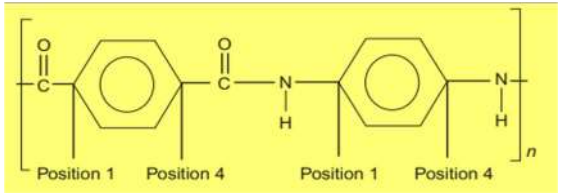
Aramid: (aromatic polyamide) Aramid fiber is mainly produced from various aromatic diamines and diacids or diacids chlorides.

Meta-Aramid: Aromatic groups linked at 1 and 3 positions;
Suppliers: Teijin & Toray;
Grade: Dyeable & Non-dyeable;
Tenacity: > 4.0 g/denier; Elongation: > 35 %;
Shrinkage: < 3.0% @ 300°C, 20 minutes;
Density: 1.38 g/cm^3

Para-Aramid: Aromatic groups are linked at 1 and 4 positions;
Suppliers: Dupont, Teijin, Kolon;
Grade: Virgin & Recycled, available in yellow, black, green colours;
Tenacity: 23 g/denier; Elongation: 3.5%;
Shrinkage: < 0.02% @ 180°C, 20 minutes;
Density: 1.45 g/cm^3







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Para-aramid fibres

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Pulp:
Used in brake pads, clutch facings, and other friction materials;
Used in gaskets, sealants, paper

Vulcanized p-aramid:
Used in conveyor belt, rubber reinforcement, friction products, sealants, automotive.

Staple fibres:
38 mm, 44 mm, 51 mm, 65 mm or higher

Filament:
200D, 400D, 1500 D;
Cutting ?
Crimping ?
Stretch-breaking ?
Cutting ?
Dyeing ?

Recycling:
Entangled form;
Cutting ?
Crimping ?
Spinning of mixed length?
Open end Vs Ring spinning ?
TFO – one end of each ?

Crimping – PBO

TO PREPARE SOP FOR EACH STAGE

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Inherent Flame-Retardant Fibres

P-aramid
1.45 g/cm^3
Highly crystalline in nature

M-aramid
1.38 g/cm^3
Polymer chains are irregular and more amorphous

PBO
1.54 g/cm^3
Rigid rod-like polymer chains, denser and less bulky

PBO + M-aramid (50/50)

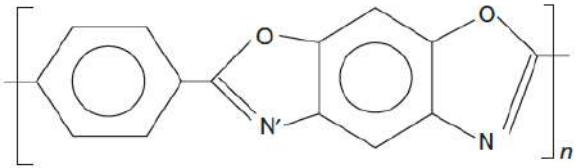
TO PREPARE SPINNING SOP FOR HIGH PERFORMANCE FIBRES

Liquid Crystalline Aromatic Heterocyclic Fibres

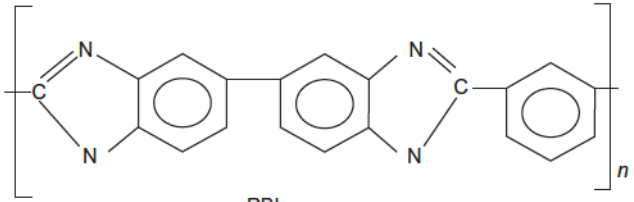
Aromatic Heterocyclic Fibres can be classified into three main categories:

- Polybenzazole (lyotropic behaviour) – e.g. PBO fibres, *Zylon by Toyobo*;
- Polybenzimidazole – e.g. PBI fibres by *PBI Performance Products*;
- Polypyridobisimidazole – e.g. PIPD fibres..

Heterocycle: A ring structure that includes at least one atom other than carbon (heteroatom). Common heteroatoms include nitrogen (N), oxygen (O), and sulphur (S)



Polybenzoxazoles fiber.



PBI

Inherent Flame-Retardant Fibres (PBO)

- Polybenzoxazoles: This fiber is produced through polymerization of benzoxazoles monomer;
- This comprises aromatic groups as well as a rigid benzoxazole segment;
- Very high thermal stability, the decomposition temperature of this fiber is nearly 650°C, and its LOI value is >68%;
- Density: 1.54 g/cm^3;
- It has also been found that a negligible mass loss occurs when heated to 500°C as compared with meta-aramids and para-aramids;

पेटेंट कार्यालय,भारत सरकार
पेटेंट प्रमाण पत्र
(पेटेंट नियमावली का नियम 74)

The Patent Office, Government Of India
Patent Certificate
(Rule 74 of The Patents Rules)

क्रम सं/SL No :011206828

पेटेंट सं. / Patent No. : 530446

आवेदन सं. / Application No. : 202111016438

फाइल करने की तारीख / Date of Filing : 07/04/2021

पेटेंटी / Patentee : Nandan Kumar

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *PROCESS OF MANUFACTURING A THERMALLY INSULATING ROVING YARN AND A TEXTILE THEREOF* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख अप्रैल 2021 के सातवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *PROCESS OF MANUFACTURING A THERMALLY INSULATING ROVING YARN AND A TEXTILE THEREOF* as disclosed in the above mentioned application for the term of 20 years from the 7th day of April 2021 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख : 27/03/2024
Date of Grant :

पेटेंट नियंत्रक
Controller of Patents

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, अप्रैल 2023 के सातवें दिन को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 7th day of April 2023 and on the same day in every year thereafter.

Inherent Flame-Retardant Fibres (PBI)

- Polybenzimidazole - IFR fibre by 'PBI Performance Products', USA;
- Developed in the 1960s by Celanese;
- Manufactured through chemical reaction of tetra-aminobiphenyl (TAB) and diphenylisophthalate (DPIP);
- PBI fiber comprises nitrogen, which makes it fire-resistant, aromatic groups are present within its chemical structure;
- This fiber does not disintegrate easily in the presence of intense temperature, LOI value >41%;
- Low thermal conductivity, so less heat is transferred into the gear to the wearer;
- Strength is lower so blended with p-aramid for making fire protection suit.

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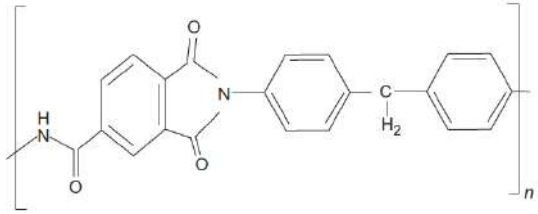
Inherent Flame-Retardant Fibres (ABPBI - India)

Inherent Flame-Retardant Fibres (Polyamide-imide fibres)

- Kermel: Example of Polyamide-imide fiber;
- A commercially available poly(aramid-imide) fiber developed in France in 1971;
- The chemical structure of Kermel fiber comprises a high proportion of aromatic groups, the crystallinity of this fiber is low;
- Due to all these structural features, the LOI value of Kermel is 33%;
- High abrasion resistance, thermal conductivity lower than any other aramid fibres;
- Excellent resistance to chemicals;
- Solution dyed in different colours for better UV light fastness and washing;
- Blended with FR viscose on 70/30 and 50/50 basis for wearer comfort;
- At 400°C, only 5% weight loss reported;
- Moisture regain – 4%



Poly(aramid-imide) fiber.

Application:

1. Army
2. Air force
3. Navy
4. Police forces
5. Filtration media

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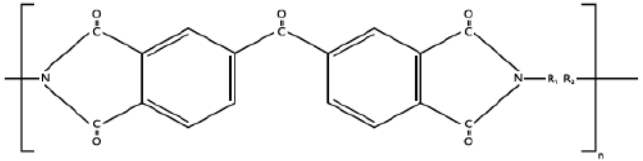
Inherent Flame-Retardant Fibres (Polyimide fibres)

- P84 is a commercially available IFR polyimide fibre;
- Wide range of operating temperature from cryogenic (-270°C) to high temperature (300°) applications;
- Multilobal cross-section offers 90% more surface area compared to round fibres;
- Increased surface area results in highest filtration efficiency as compared to conventional fibres;
- Colour – natural golden yellow;
- Tenacity > 4.0 cN/dtex;
- Elongation – 20%;
- Shrinkage at 280°C, 30 minutes - <0.3%;
- Thermal conductivity at 300°C – 0.03 W/m.K;
- Resistant to UV rays;
- Density – 1.4 g/cm^3 lower than PBO (1.58 g/cm^3)



Golden Yellow colour & Multilobal cross-section of P84

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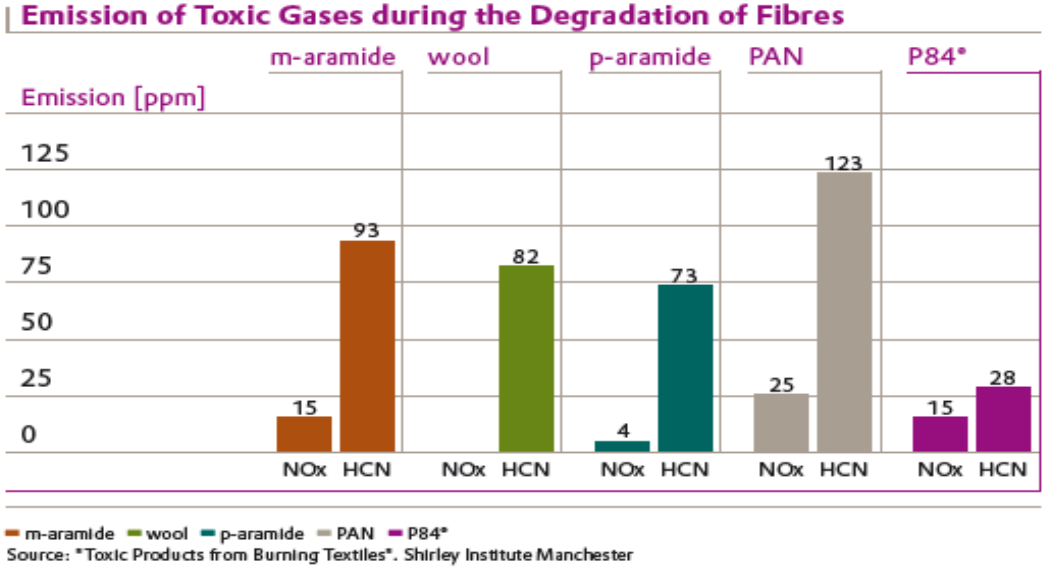
Inherent Flame-Retardant Fibres (Polyimide fibres)



Gas volume and gas composition are strongly depending on conditions like excess or shortage of oxygen. Under the chosen conditions, P84® fibres show the lowest generation of toxic HCN (cyanic acid).

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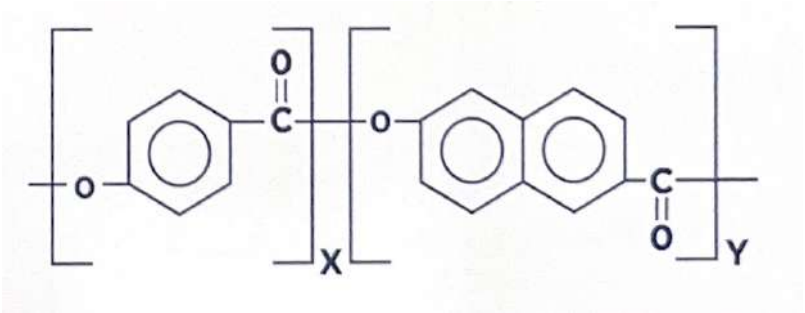
Difference between PAI and PI fibres

Property	Polyamide-imide (PAI) Fibers	Polyimide (PI) Fibers
Chemical Structure	amide (-CONH-) and imide (-CON-) linkages	imide (-CON-) linkages
Thermal Stability	High, 260°C or higher	Very high, 400°C or higher
Flame Resistance	Excellent	Outstanding
Mechanical Strength	High tensile strength and modulus	High tensile strength and modulus
Chemical Resistance	Good resistance - solvents, oils, and chemicals	Excellent resistance to solvents, oils, and chemicals
Moisture Absorption	Moderate	Low
Electrical Properties	Good electrical insulation properties	Excellent
Flexibility and Toughness	Good balance of flexibility and toughness	High toughness with moderate flexibility
Applications	High-performance seals, bearings, electrical components, and aerospace parts	High-temperature filtration, aerospace, electronics, and advanced composites
UV Resistance	Moderate	Excellent
Environmental Resistance	Good resistance to harsh environments	Excellent resistance to harsh environments
Colour Stability	May discolor at high temperatures	Retains colour stability

Liquid Crystalline Aromatic Copolyester Fibres

Aromatic Copolyester Fibres

(thermotropic behaviour – formation of ordered phases over a wide temperature range: e.g. *Vectran, Kuraray, Japan* - a copolymer of p-hydroxybenzoic acid and napthhoic acid;



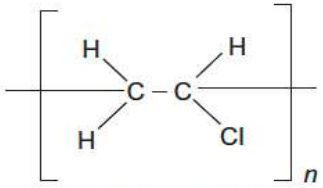
High strength and modulus;
Abrasion resistance;
Excellent fold/flex characteristics;
Minimal moisture absorption;
Chemical resistance (Bleach resistance);
Cut-resistance;
High impact strength

- LOI 30;
- Melting point – 350°C;
- Moisture regain (%) < 0.1;
- Boiling water shrinkage, 100°C, 30 minutes < 0.2%

Applications:
Ropes & Cables
Aerospace
Industrial and Electronics

Inherent Flame-Retardant Fibres (PVC)

- Chlorofibre is non-flammable and manufactured by polymerization of vinyl chloride;
- Does not burn or emit flames or release molten incandescent drops to spread fire to other combustible materials;
- The chemical structures of PVC or polyvinylidene chloride fibers comprise polymeric repeat unit (–CHCl, –CCl2), which creates a high degree of chain order and thermal resistance;
- Good resistance to concentrated acids, bases, oxidizing and reducing agents;
- Can be dyed in different colours and no change in mechanical properties in chlorinated water, such as swimming pool water;
- Not affected by most of the micro-organisms in water;



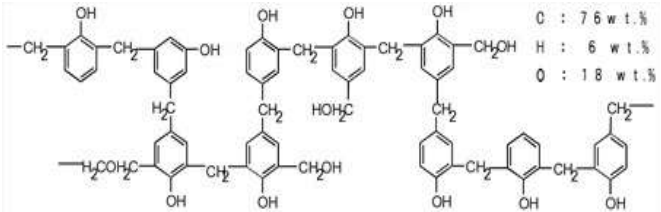
Polyvinyl chloride

Polymer	Thermal conductivity at 20°C (W/m.K)	Heat capacity (kJ/kg.K)
Polyvinylchloride	0,168	0,96
Polyester	0,218	1,13
Polypropylene	0,172	2,14

PVC has both low thermal conductivity and a low heat capacity, i.e. absorbs and transfers least quantity of heat.

Novoloid fibres: Kynol

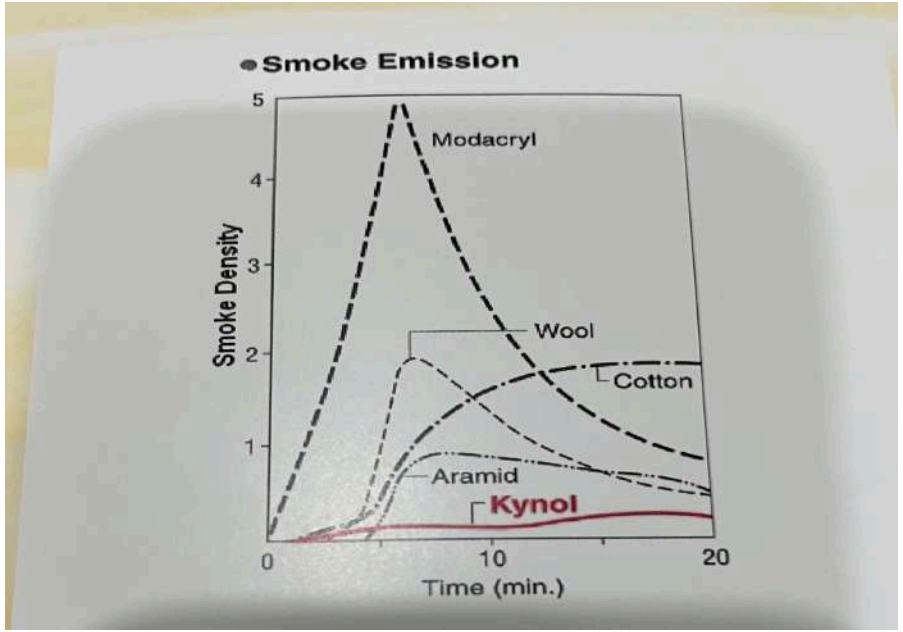
- Kynol (Novoloid) is inherent flame-retardant and are melt-spun phenol-aldehyde resin-based fiber;
- Chemical structure - 76 wt.% carbon (C), 18 wt.% oxygen (O), and 6 wt.% hydrogen (H). Due to the high carbon content, used as precursor in production processes for carbon fibers which are used as activated materials dedicated for the absorption of chemicals;
- Kynol fibres have low thermal conductivity due to bulk aromatic phenolic groups;
- High LOI-values (Limiting Oxygen Index) of 30–34% and a maximum temperature of usage (T*max*) of 150°C-200°C;



- Excellent flame resistance;
- Excellent chemical resistance;
- Can withstand short-term heat exposure in temperatures > 1000°C;
- Excellent thermal insulator;
- Low smoke and combustion toxicity;

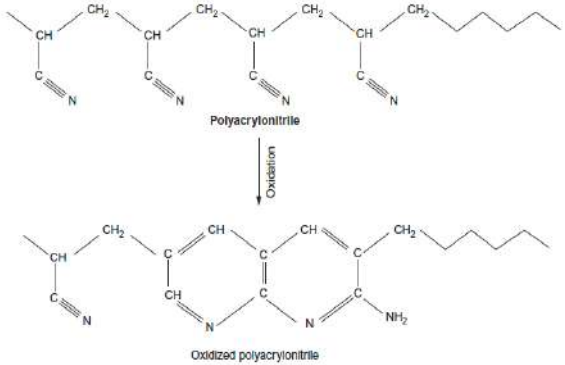
Novoloid fibres: Kynol

- Colour – gold;
- Specific gravity (ratio) – 1.27;
- Tensile strength – 1.3-1.8 g/den (12-16 cN/tex);
- Modulus – 260-350 cN/tex;
- Elongation - Above 10%;
- Moisture Regain (at 20C, 65%RH) – 6%;
- LOI – 30-34;
- Low shrinkage allows charred material to retain its integrity as a barrier to keep heat and oxygen away from the interior of fibre structure;
- Water vapour and CO_2 evolved after combustion;
- Due to the absence of nitrogen, sulphur or halogens in the chemical structure, the burning gases from Kynol fibers do not contain toxic components such as NOx, SO2, HCN, HCl or HF;



Semi-Carbon/Pre-oxidized (OPAN) acrylic fibres

- Semi-carbon (Peroxidized Acrylic): Produced through partial oxidation of polyacrylonitrile polymer using itaconic acid as a co-monomer. Through this oxidation process, partial carbonization of this polymer occurs and is called semi-carbon fiber;
- Carbonization and crystallization of viscose fiber can also be used to manufacture semi-carbon fiber; however, this process is cumbersome as well as costly;
- It has been observed that the LOI value of this fiber can reach up to 55% and can resist temperatures up to 1000°C;
- No smoke, toxic gases, or afterglow even during and/or after intensive flame exposure;
- Poorly abrasion resistance, handling, and shelf life. Mostly blended with other chemically modified fire-retardant fibers;
- Also aluminized to produce firefighters' clothing.



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MANMADE AND TECHNICAL TEXTILES EXPORT PROMOTION COUNCIL

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Institute of Technical Textiles

Semi-Carbon/Pre-oxidized (OPAN) acrylic fibres - India

Inherent Flame-Retardant Fibres: FR Viscose fibres

- FR Viscose: Inherent Flame-Retardant cellulose fibres;
- Soft and comfortable, Dyeable, 10-13 USD per kg;
- Blends: with para-aramid, meta-aramid, PBO,PBI;

- When a fabric containing FR viscose fibre is exposed to flame, the additive begins to decompose at a lower temperature than the decomposition temperature of the cellulose surrounding it;

- Main decomposition product is phosphoric acid. The acid polymerises and catalyses the dewatering and carbonisation of the cellulose and increases the production of non-combustible fragments such as CO_2 and H_2O.

Patent on Arc-flash protective fabric

INTELLECTUAL PROPERTY INDIA

क्रम संSL No :011190990

पेटेंट कार्यालय,भारत सरकार
पेटेंट प्रमाण पत्र
(पेटेंट नियमावली का नियम 74)

The Patent Office, Government Of India
Patent Certificate
(Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No. : 495294

आवेदन सं. / Application No. : 201911016122

फाइल करने की तारीख / Date of Filing : 23/04/2019

पेटेंटी / Patentee : High Performance Textiles Pvt Ltd

प्रमाणित किया जाता है कि पेटेंटी को उपरोक्त आवेदन में यथाप्रकटित *A PROTECTIVE TEXTILE* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख अप्रैल 2019 के तेइसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *A PROTECTIVE TEXTILE* as disclosed in the above mentioned application for the term of 20 years from the 23rd day of April 2019 in accordance with the provisions of the Patents Act.1970.

अनुदान की तारीख : 05/01/2024
Date of Grant :

पेटेंट नियंत्रक
Controller of Patents

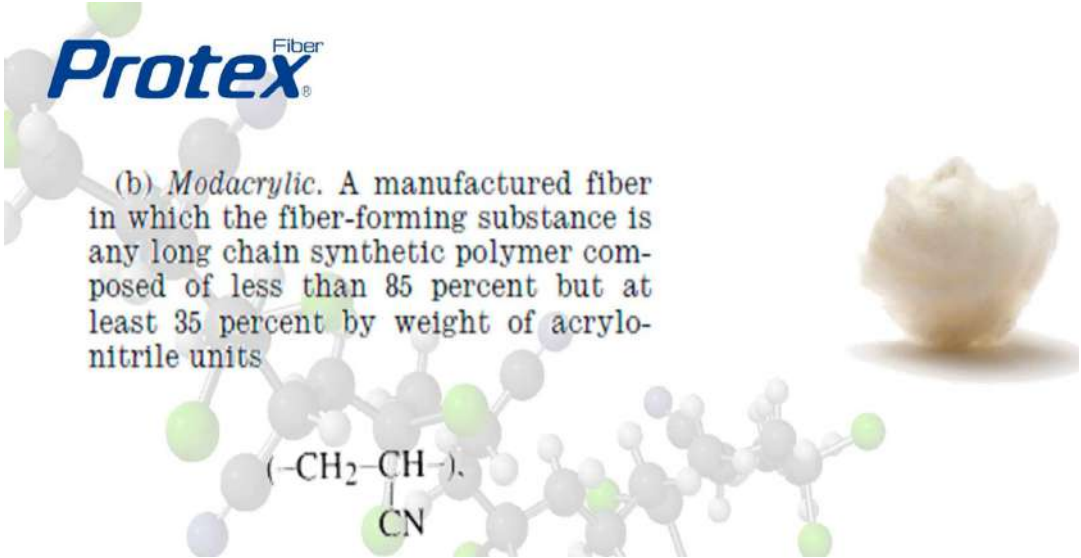
टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, अप्रैल 2021 के तेइसवें दिन को और उसके पश्चात प्रत्येक वर्ष से उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 23rd day of April 2021 and on the same day in every year thereafter.

Inherent Flame-Retardant Fibres: Modacrylic

Modacrylic: Modified acrylic fibers made from acrylonitrile, Protex brand (from Kaneka, Japan) inherent flame-retardant fibres for protective and home furnishing, Dyeable; price range:7-12 USD per kg; Antimony trioxide is generally used as additives while producing modacrylic fibres:-

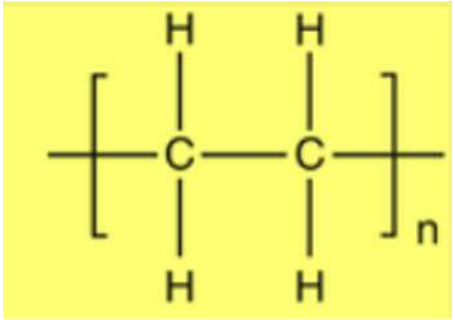
- Protex C;
- Protex Q;
- Protex M;
- SBY;



High Strength Fibres: UHMwPE

ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE

- High molecular weight polyethylene (molecular weight higher than 1,500,000 Da);
- High strength (30-35 g/denier), low elongation less than 4%, good abrasion, chemical resistant, high thermal conductivity; hydrophobic in nature;
- Staple fibres, filaments in various deniers available (100 denier, 200 denier, 300 denier, 400 and 600 denier), Price range – 10 USD- 150 USD per kg;
- Blended with steel, glass, basalt for high cut performance;
- Blended with cotton for high abrasion resistance;
- Low melting point, 120°C (recent development, blended with Aramid – core spun)



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Inorganic Fibres: Basalt & Glass

Basalt: made from extremely fine fibers of basalt, which is composed of the minerals, available in staple and filament form.
Price range: 12-15 USD per kg (200 and 300 denier available for protective textiles)

Glass: made from silica sand and between 5.5-9.0 µ glass filaments are used for protective textiles, above 9 µ are used for weaving, braiding, nonwoven applications; 100-300 denier most-commonly used in protective textiles.
Different grades: E glass, ECR glass, S Glass;
Price range: 4-9 USD per kg,
Higher for PTFE coated or on bigger bobbins.

Metallic fibres

- **Steel wire:** These are used in cut protective textiles in size ranging from 30-70µ. Price range: 12-30 USD per kg;

- **Stainless steel fibre:** These are 8 micron steel fibres blended with other high-performance fibres such as PBO, aramid, polyester etc to achieve antistatic and conductive properties. Price range: 50-90 USD per kg;

- **Tungsten wire:** Very dense metal as compared to stainless steel (19.25 Vs 8.03 g/cm3), X rays detectable and can be used to achieve higher cut performance. Price range: 150 USD per kg;

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Other fibres

- Carbon fibres
- PVA fibres
- Low melt fibres
- FR nylon
- PEEK fibres
- Polycrystalline (Alumina) fibres
- Polyacrylate fibres
- Antistatic (carbon based) fibres
- Polyphenylene sulphide fibres

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Testing & Validation (Mechanical Hazards)

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Testing & Validation (Thermal & Electrostatic Hazards)

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Training Workshops

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INSTITUTE OF TECHNICAL TEXTILES PVT LTD
145, HSIIDC, Barhi Industrial Area, Phase –I, Barhi, Gannaur, Sonipat, Haryana-131101, India

Training program on the manufacturing & testing of technical textiles (29th July - 31st July 2024)

SCHEDULE

Day 1 (29th July 2024)

S.No.	Topic	Category	Time
1	Introduction & registration	Welcome Session	09:30 AM to 10:00 AM
2	Introduction to 'High Performance Fibres'	Lecture	10:00 AM to 11:00 AM
3	Introduction to 'Blowroom & Carding'	Lecture	11:00 AM to 11:45 AM
	Tea Break		
4	Introduction to humidification plant	Lecture	12.00 PM to 1.00 PM
	Lunch		
5	Trial on 'Blowroom and Carding' (p-aramid fibres)	Demonstration	2.00 PM onwards

Day 2 (30th July 2024)

S. No.	Topic	Category	Time
1	Introduction to 'Drawframe & Speedframe'	Lecture	10:00 AM to 11:00 AM
2	Introduction to 'Ringframe'	Lecture	11:00 AM to 11:45 AM
	Tea Break		
3	Introduction to 'Autoconer'	Lecture	12.00 PM to 1:00 PM
	Lunch		
4	Trial on 'Drawframe, Speedframe, Ringframe, Autoconer' (para-aramid fibres)	Demonstration	2:00 PM onwards

Day 3 (31st July 2024)

S. No.	Topic	Category	Time
1	Introduction to protection against mechanical hazards: EN 388:2016 & electrostatic hazards: EN 1149:2008	Lecture	10:00 AM to 11:00 AM
2	Introduction to protection against thermal hazards: EN 407:2020	Lecture	11:00 AM to 11:45 AM
	Tea Break		
3	Introduction to fire proximity clothing: opportunities & challenges	Lecture	12.00 PM to 1:00 PM
	Lunch		
4	Testing of samples (abrasion, cut, tear, puncture, impact, flammability, contact heat, convective heat, radiant heat, small & large drops of molten metals, resistance measurement, charge decay test)	Demonstration	2:00 PM onwards

** Mobile phones are not permitted in the production area.*

REGISTRATION CHARGES

1) Free for B. Tech. (3rd and final year) students;
2) Others: Rs. 5000/- (one day) & Rs. 15000/- plus taxes (all three days);
3) Contact textilopedia@gmail.com or message +91 9996625050 for registration;
4) Lecture Venue: Cozzet Deera Sonipat – A Cygnett Hotel, 55 Milestone, NH01, Sonipat, Haryana, Mobile: +91 8510047006.

CIN: U74909HR2023PTC116198

INSTITUTE OF TECHNICAL TEXTILES PVT LTD

ITT INSTITUTE OF TECHNICAL TEXTILES
www.itt-india.com
TC-13890

TWO DAYS TRAINING PROGRAM
13th & 14th September 2024

PROTECTIVE TEXTILES
Protection against mechanical, thermal & electrostatic hazards
(Participants may bring two samples to test during the workshop)

- Abrasion (Martindale & Taber)
- TDM cut tester
- Tear resistance
- Puncture resistance (Steel stylus & hypodermic needles)
- Impact resistance (Hand, limb & back protector)
- Flammability (surface & edge)
- Contact heat
- Convective heat
- Radiant heat
- Small splashes of molten metal
- Large splash of molten metal
- Half charge decay tester
- Surface resistance measurement

Discussion session on standards: EN 388, EN407, EN 420, ISO 11612, ISO 11611, EN 469, EN 1486, EN 1149, EN 13594, ASTM F1506, ASTMF1414, ISO 11393, ISO 9185, ISO 12127, ISO 6942, ISO 9151, ISO 5077, ISO 17493, ISO 16073, ISO 3146, ISO 15025, ISO 15383, ISO 13997, ISO 13998, ISO 4589.

Notes:
- **Registration fee: Rs. 5000.00/ each day + GST;**
- **Special discount available for more than one person coming from the same company.**

Institute of Technical Textiles Pvt Ltd
Plot No. 145, Phase I, HSIIDC, Barhi, Sonipat, Haryana, India, 131101
info@itt-india.com, textilopedia@gmail.com

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Protective Textiles: Way forward

Collaborations: Industry/Academia (NTTM – excellent initiative)

Materials: Supply Chain of high-performance fibres/need to develop and promote indigenous fibres – pilot plant concept;

Awareness: Limited knowledge at ground level especially with small and medium scale industries, Need to prepare SOP for each fibres;

Prototyping/Sampling: Very difficult to get sampling of smaller lots in various combinations, spinning, weaving, nonwoven (to process 100 kg of each);

Testing & Validation: To strengthen our laboratories in India to stop pirated or sub-standard products.

ESTD. 1954

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मानव निर्मित और तकनीकी वस्त्र निर्यात संवर्धन परिषद
MANMADE AND TECHNICAL TEXTILES EXPORT PROMOTION COUNCIL

(Formerly SRTEPC)

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Nandan Kumar (PhD),
Director,
High Performance Textiles Pvt Ltd
nandan@hpt-india.com

Institute of Technical Textiles Pvt Ltd
info@itt-india.com
Mobile: +91-9996625050