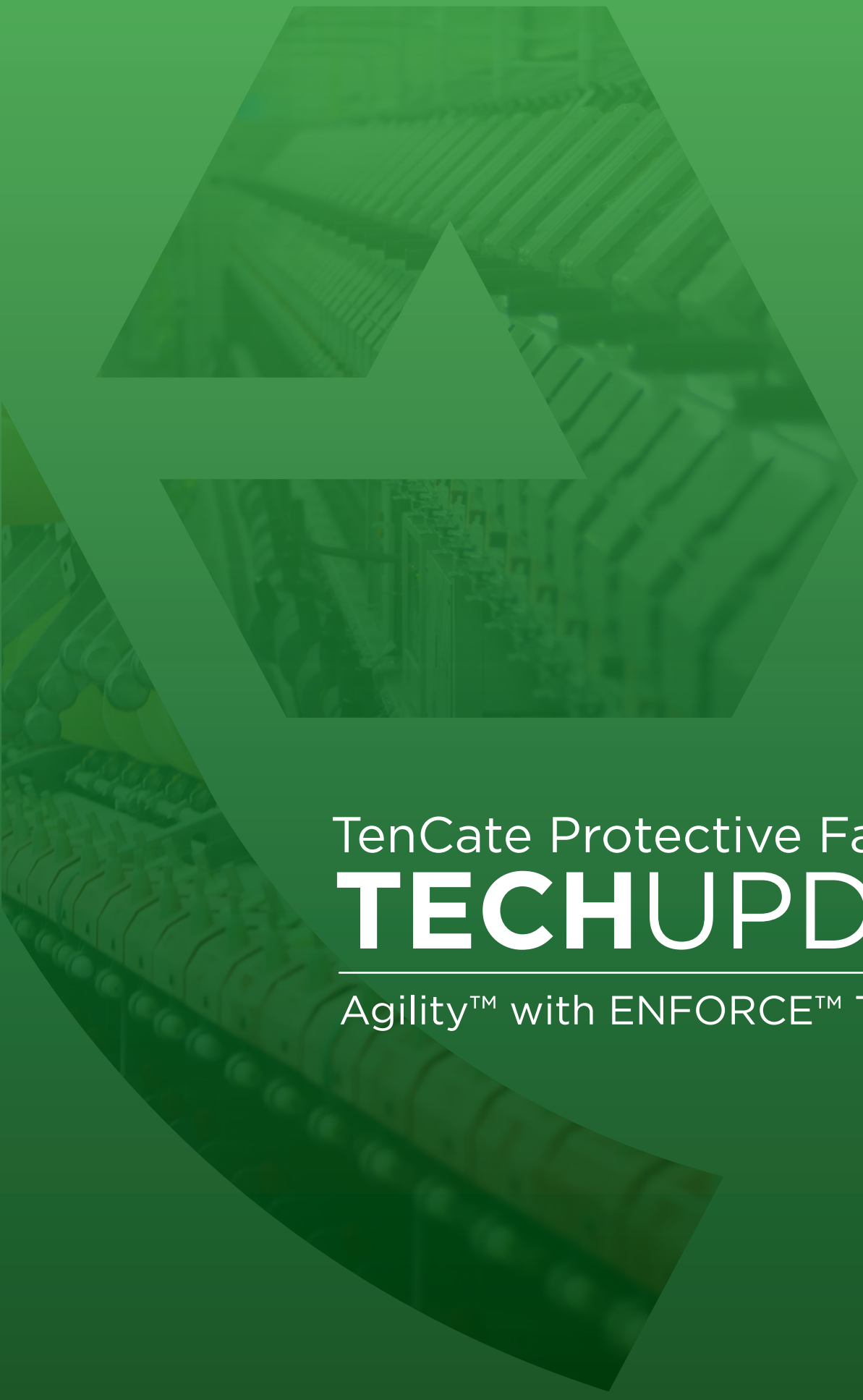


TenCate Protective Fabrics

TECHUPDATE

Agility™ with ENFORCE™ Technology

THE NEXT WAVE
OF INNOVATIVE
ENGINEERING
FEATURING
ENFORCE™
TECHNOLOGY

1 Maximum protection in a lighter weight fabric

2 Excellent strength after thermal exposure

3 Less weight means less risk of heat stress

TenCateFabrics.com/Agility

AGILITY
WITH ENFORCE™ TECHNOLOGY

Are you looking for an outer shell with some muscle that moves with you? TenCate Protective Fabrics introduces the next generation in our line of innovative outer shells: Agility™ with ENFORCE™ Technology.

Building on the success of outer shells Ultra™ and Millenia™ XT, the Engineers at TenCate Protective Fabrics reduced the weight of the fabric without sacrificing the strength.

Ultra™	7.5 osy (245 gsm)
Millenia™ XT	7.5 osy (245 gsm)
Agility™	6.6 osy (225 gsm)

That means Agility™ with ENFORCE™ Technology is about 10 percent lighter. The use of a twill weave in the fabric design delivers greater comfort and ease of movement with 31% improved flexibility over Ultra™ and 61% better than Millenia™ XT.

What's really remarkable about Agility™ with ENFORCE™ Technology is that it still has all the strength of those heavier outer shells. Compared to the average dual-aramid blend outer shell, Agility™ is more than 6 times stronger after a TPP exposure of 17.5 seconds. Before exposure, Agility™ is stronger than almost all other outer shells available today (see charts on following pages).

Where does it get the strength? TenCate engineers it using the blend of DuPont™ Kevlar® and PBO fibers — some of the strongest in the world. The proprietary engineering of ENFORCE™ Technology uses super-strength strands of high-tenacity fibers. This is to replace ripstop weaves and continuous filament to allow for a more flexible, comfortable fabric. It also allows the outer shell fabric to have a smoother surface that is less susceptible to abrasion issues.

Agility™ with ENFORCE™ Technology is available in Light Gold, Dark Gold and Black Gold.

FABRIC

TenCate Agility™ with ENFORCE™ Technology

CONSTRUCTION

Woven (Twill)

COLORS AVAILABLE

Light Gold, Dark Gold, Black Gold

FINISH

Super Shelltite™

MADE IN AMERICA

Yes

CERTIFICATION

NFPA 1971

PROTECTION

TPP	THL
40-46	221-272

Q. Is PBO dangerous to fire-fighters?

A. No. PBO as a fiber has been used in multiple fabrics for the fire service over the last decade. Several outer shell fabrics containing PBO have been used in some of the harshest conditions.

These outer shells, including Millenia™ XT, Millenia™ XTL and Ultra™, have experienced a very dedicated following among some fire departments. A TenCate representative is glad to provide referrals about these departments.

Q. Is TenCate experiencing a shortage of PBO fiber?

A. No. TenCate Protective Fabrics would like to assure you the supply chain of PBO fiber remains robust with plenty in stock and no delays in delivery. Any remarks you may have heard or may hear in the future relating this information are wholly inaccurate and intended only to frighten the market.

Q. Why is TenCate retiring outer shell fabrics containing PBO?

A. Over the past five years, fabric technology has advanced significantly. Our engineers have developed some of the most comfortable, durable and protective options including Agility™ with ENFORCE™ Technology.

TenCate was purchased by an equity group in 2016. The new owners decided to increase efficiency in our manufacturing facilities by retiring several older products. Ten outer shells and eight thermal liners are being transitioned, most of which do not contain PBO.

Some of the transitioning will take place over the next few years to comply with current contracts.

Q. Are outer shells containing PBO made in America?

A. Yes. TenCate creates and manufactures our outer shells at four plants in Georgia, employing more than 350 Americans who proudly produce inherently FR textiles from fiber to finished fabric. Some competitors in the marketplace like to criticize PBO fiber.

Invented in the 1980s by SRI International, an American non-profit research institute headquartered in Menlo Park, CA, PBO was sold to Toyobo Ltd. in Japan, which still produces this unique fiber today.

Many fibers are produced outside of the United States and used in FR fabrics. One example includes FR rayon, which is only available from abroad but used by the U.S. military in FR fabrics.

PBI itself begins as a polymer abroad.

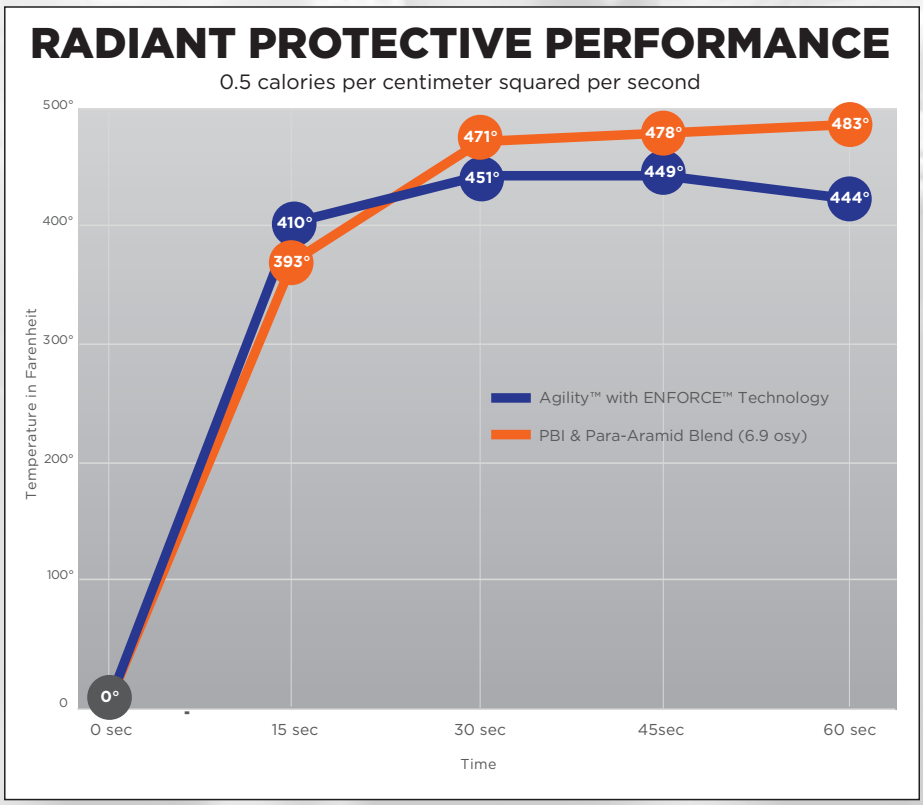
TenCate outer shell Agility™ with ENFORCE™ Technology: less than 22% of the fabric uses PBO. The remaining 78% of the fabric is a blend of DuPont™ Kevlar® and DuPont™ Nomex®, a U.S. company with its divisional headquarters in Richmond, VA.

Keep an eye on terms like para-aramid in some materials. In the case of a 6 osy outer shell, the para-aramid is Twaron, manufactured by Teijin, a Japanese corporation. Further, 58% of that outer shell's fiber is sourced from Japan.

Q. Do outer shells utilizing PBO fibers have a higher thermal conductivity than outer shells utilizing PBI fibers?

A. No. Firefighters do not wear a fiber, they wear a fabric. Each fiber that makes up the fabric holds a different level of moisture. This is called **moisture regain**. So how much water is in a fiber?

- PBO contains 2.5% water
- PBI contains 15% water
- Para-aramid has 5.5% water
- Meta-aramid has 5.5% water.



The above data was obtained by using the same test apparatus and temperature as PBI video shows. Firefighting thermal imaging cameras with TIC capability were used to measure the actual temperature of the surface of fabric. The test did not use an industrial thermal imaging camera that uses just a color difference to gauge temperature difference. At the 30-second mark, every PBI/para-aramid outer shell had a higher surface temperature than any PBO/para-aramid or any PBO/para-aramid/meta-aramid blend fabric.

Fabric that contains 60% para-aramid, 20% PBO, and 20% meta aramid will have lower water content than a one with 60% para-aramid and 40% PBI.

Water absorbs heat 25 times faster than air. Outer shells with more water in them absorb heat faster but in 15 to 20 seconds of a high-heat exposure the heat has evaporated all the moisture out of the fabric.

Q. What about the PBI video showing the difference between a PBO/para-aramid fabric and a PBI/ para-aramid fabric?

A. The video only shows the first 20 seconds of exposure. The PBO/para-aramid fabric heats up faster for the first 15 to 20 seconds because it has a low moisture content.

There is a reason the camera pans off the thermal image at the 20 second mark. From 0 to 20 seconds, the high-water content of the fabric with PBI/para-aramid will absorb more heat. At the 20-second mark, the water has evaporated. From 20 to 60 seconds, the PBI/para-aramid fabric will be a higher temperature than the PBO/para aramid fabric.

Q. Is the Taber abrasion testing a valid test?

A. Yes. The Taber test is a commonly used test in the military and industrial market.

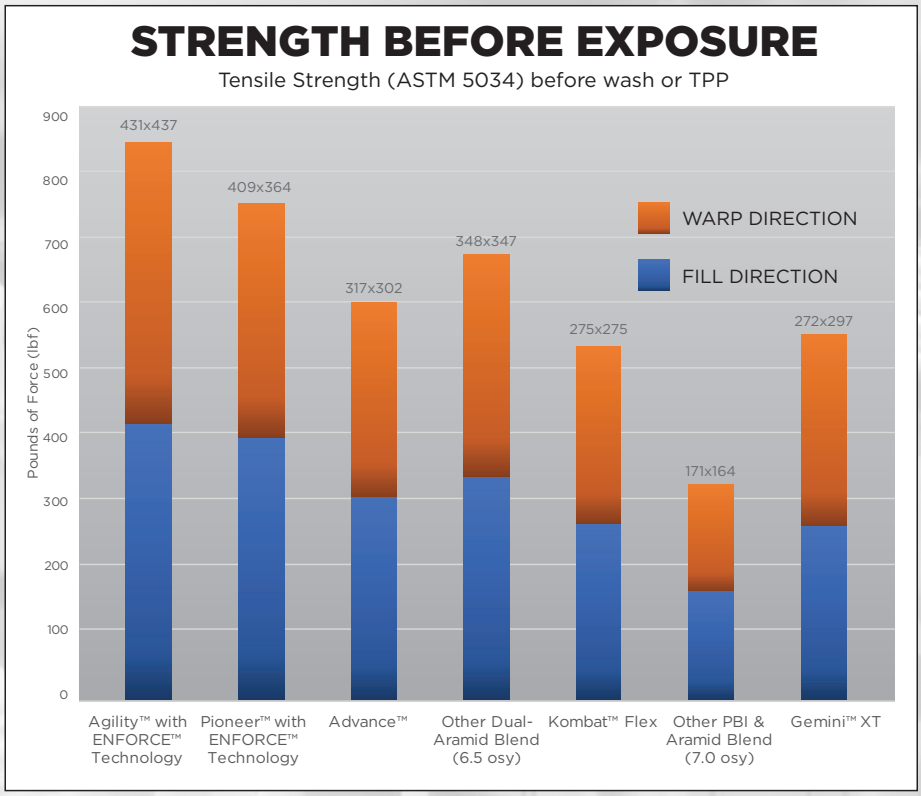
The Taber test not only shows the differences between fiber combinations but also exposes the lack of engineering of the finished fabric.

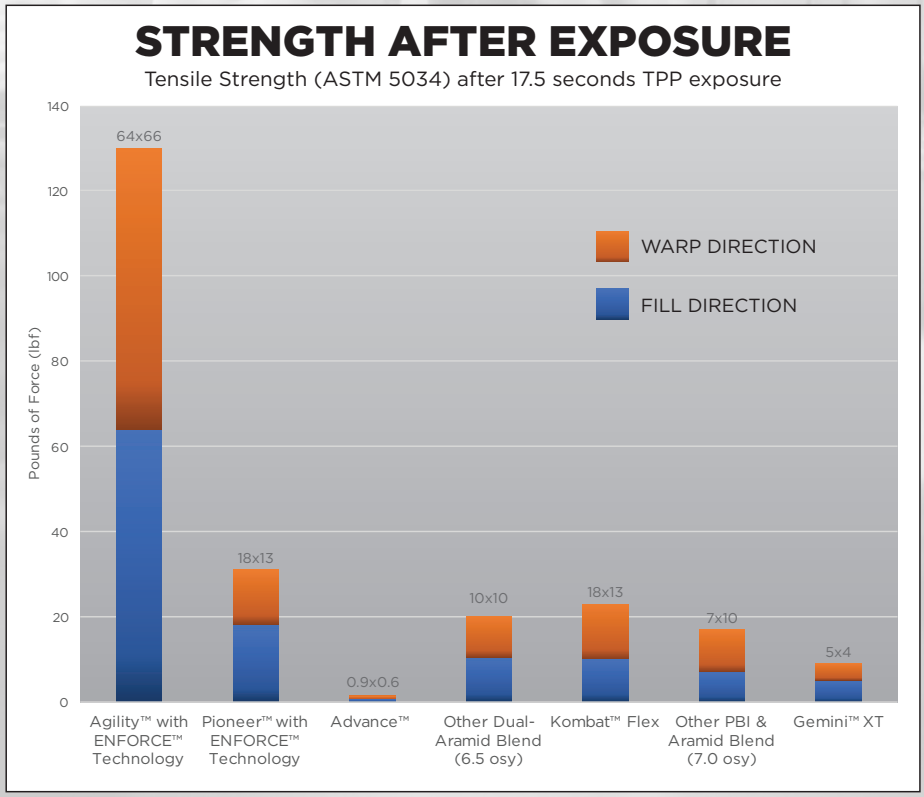
There are multiple abrasion test methods available, but the Taber is the only one that is relevant to what an outer shell is up against.

The Taber test cannot equate a number of cycles to a time frame. For example, it is never said that an outer shell that makes 5,000 cycles will be in service for 5 years. All the Taber is used for is to show that an outer shell that makes 3,000 cycles will have a better chance of staying in service and costing less in repairs than an outer shell that makes it to 750 cycles.

For anyone to insinuate that TenCate alters the Taber test method in any way is false. We invite any customer who has a question to come to TenCate, inspect our laboratory and run multiple tests for themselves.

TenCate Protective Fabrics is proud of our Made in America products. We are also proud to be forthcoming on our products and how we create them.





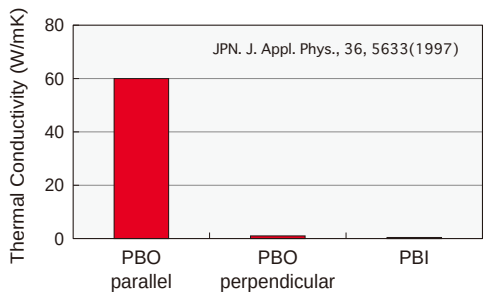
Technical Bulletin

UNDERSTANDING THE DIFFERENCE BETWEEN PBO AND PBI

Thermal Conductivity

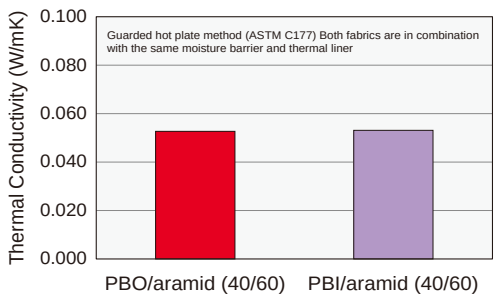
Simply stating that PBO conducts more heat than PBI is oversimplification. When measuring thermal conductivity along the fiber, third party data shows that PBO transfers more heat and thermal energy than PBI. In other words, PPE made with PBO coolsdown at a faster rate.

Thermal conductivity measured perpendicular or across the fiber is about the same as PBI. As a result, PPE made with PBO shows equivalent TPP performance as PPE made with PBI.



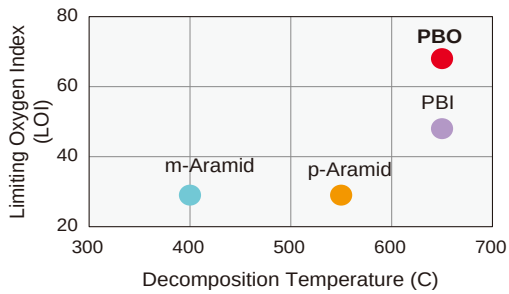
Flame Protection

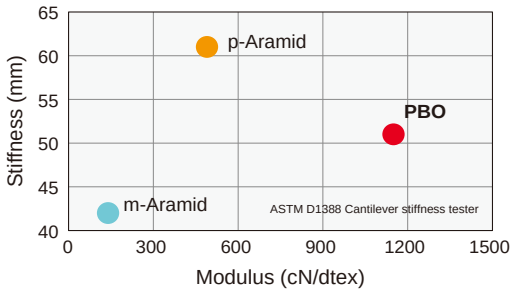
Most fibers used to produce PPE do not have a melting temperature, however these fibers do decompose. This decomposition temperature is the point at which the fiber begins to carbonize. In applications requiring flame protection, a fiber's limiting oxygen index (LOI) is also very important. Since oxygen is required for combustion, higher LOI means the fiber is less likely to ignite. PBO offers a more balanced performance between LOI and decomposition temperature.



Modulus

In the textile industry, it is well known that fiber tensile modulus does not directly influence the stiffness of the fabric. Other factors such as weave pattern and fabric finishing also determine fabric softness. Data taken from testing three different fabrics, each constructed of 100% meta-aramid, para-aramid or PBO with same weave and finishing, demonstrate that there is no direct correlation between stiffness of fabric and tensile modulus. Case in point, even though tensile modulus of PBO fiber is twice that of p-aramid the fabric made with PBO shows more flexibility.

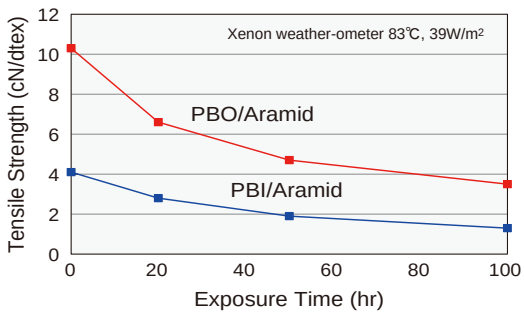




Durability

Tensile strength of PBO is twice that of p-aramid and 10 times that of PBI. Even after exposure to UV light over the life of the garment and during firefighting, PBO maintains higher strength than PBI.

PBO fiber is used in over 50 high performance applications worldwide. Engineers at NASA and in various industries – commercial aerospace, motorsports, sporting goods, sailing, construction – choose PBO for its unique and dependable properties.



TOYOBO
Ideas & Chemistry

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Kita-ku, Osaka 530-8230, Japan
http://www.toyobo-global.com/seihin/kc/pbo/

AGILITY™
WITH ENFORCE® TECHNOLOGY

Nominal Weight	6.6 osy (225 gsm)
Special Feature	Tencate ENFORCE™ Technology (Patent Pending)
Fiber Blend	DuPont™ Kevlar®, DuPont™ Nomex®, PBO
Weave	Twill
Colors	Light Gold, Dark Gold, Black Gold
Finish	Super Shelltite™
Made in America	Yes
Certifications	NFPA 1971

TPP UL Certified results using Gore® CROSSTECH® Black moisture barrier	NFPA 1971
Quantum3D® SL2	44 - 46 (6.7 - 7.0 per osy)
Caldura® SL2	42 - 44 (6.4 - 6.7 per osy)
Defender® M SL2	44 - 46 (6.7 - 7.0 per osy)

THL UL Certified results using Gore® CROSSTECH® Black moisture barrier	NFPA 1971
Quantum3D® SL2	250 - 260 (37.9 - 39.4 per osy)
Caldura® SL2	260 - 275 (39.4 - 41.2 per osy)
Defender® M SL2	220 - 230 (33.3 - 34.8 per osy)

Trap Tear	ASTM 5587, NFPA 1971 (WARP X FILL)
initial	65 x 61 lbf (289 x 271 N)
5x after wash	55 x 66 lbf (245 x 294 N)

Tensile Strength	ASTM m5034 (WARP X FILL)
initial	459 x 462 lbf (2,042 x 2,055 N)
10x after wash	359 x 419 lbf (1,597 x 1,864 N)

Flame Resistance	ASTM D6413, NFPA 1971, CHAR LENGTH (WARP X FILL)
initial char length	0.3 in x 0.3 in (8 x 8mm)
5x after wash	0.3 in x 0.3 in (8 x 8mm)
after flame	0 sec

Thermal Shrinkage	NFPA 1971-2013
initial	<1.0%
5x after wash	<1.0%

Water Absorption	AATCC 42
initial	<1.0%
5x after wash	<1.0%

DuPont™ Kevlar®

TENCATE PROTECTIVE FABRICS

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