ACCOMPLISHING FLAME-RESISTANT PROTECTION:

THE SCIENCE BEHIND THREE FR TECHNOLOGIES

The core of effective FR/AR garments is the FR fabric—it forms the foundation in both daily wear and task-based PPE. FR fabric, when effectively manufactured, either snuffs out a flame or resists breaking down when exposed to flames or intense heat, such as an arc flash or flash fire. While multiple FR fabric technologies enable an FR garment to self-extinguish when a thermal source, or flame, is removed, there are differences in how the fabrics are engineered. These differences are helpful to understand when specifying FR fabrics for your FR/AR PPE program needs.

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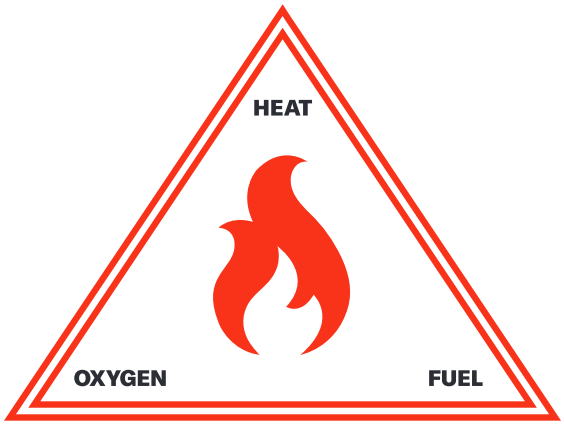
*This article originally appeared in the July/August 2019 edition of **EHS Today** magazine.*

To understand how and why FR fabric technologies work, we must first have a basic knowledge of how a flame works. A flame is a complex chemical chain reaction that requires three components: heat, fuel and oxygen.



Once a flame is ignited, it needs all three of these factors to continue burning. Without one or more of these components, the fire will extinguish.

FR fabric technologies utilize this concept to help protect wearers in two major ways: first, once a thermal source is removed, FR garments will not continue to burn, and second, they provide sufficient insulation from second- and third-degree burns. When specified and worn correctly, FR garments can help to provide enough time for workers to quickly remove themselves from the thermal hazard. While FR clothing will not prevent burns entirely, they can help drastically reduce the severity of burn injuries resulting from short-duration thermal exposure and significantly increase the probability of survival. Let's examine the three technologies that can be applied to fabrics to accomplish this protection.

SOLID-STATE TECHNOLOGIES

Applying solid-state technologies to fabrics interrupts a flame's chain reaction by producing a solid char. This char creates a barrier between the flame and the fabric to eliminate the fuel which the flame requires in order to continue burning.

Solid-state technologies are applied to fabrics in two ways: treating the fabrics or engineering the fabrics. In treated fabrics, an FR coating is applied to the surface of the fabric, however this does not bond the FR coating permanently to the fabric.

Engineering fabrics, on the other hand, involves permanently bonding FR technologies directly to the textile fibers, which prevents FR qualities from diminishing over time. By utilizing engineered solid-state FR technologies, a vast array of fabrics, including cotton, can offer FR properties while maintaining their original qualities—including weight, breathability and softness. As such, industrial workers no longer have to wear FR apparel that is stiff, uncomfortable or non-breathable for adequate protection against thermal hazards.

KEY TAKEAWAYS

When engineered in fabrics, solid-state technologies will not wash out or wear off of fabrics when cared for properly. Generally, PPE with these technologies is popular and widely used across industries because it tends to be more flexible and comfortable to wear for longer periods of time. Additionally, the fabric can maintain the comfort of cotton with added FR performance. These technologies are often seen in daily wear apparel, including denim jeans and work coats, in addition to items in public spaces such as curtains and couches. Solid-state technologies can be used to protect against electric arc flashes, flash fires, molten metal splash or welding exposure thermal hazards.

THERMALLY STABLE FR TECHNOLOGIES

Thermally stable, or inherent, fibers do not melt, breakdown or decompose when exposed to heat. As a result, in the event of an arc flash or flash fire, a flame does not have any fuel to burn on the fabric and will quickly self-extinguish. Also known as aramid fibers, these fibers are strong and do not tear easily, which makes the technology ideal for FR PPE.

KEY TAKEAWAYS

Thermally stable FR technologies are a permanent feature of the fabric and cannot be washed out. Additionally, the strong, tear-resistant fibers create a long lasting, resilient FR protection. When used on their own, thermally stable FR technologies can help guard against prolonged thermal exposures. When the technology is blended with fabrics that contain other FR technologies such as cotton, rayon, polyester or nylon, it creates durable FR protection against short-term thermal hazards in the gas and electrical industries. Thermally stable technologies are ideal for military flight suits, turnout fire gear and motor sports. Additionally, they are used in the petrochemical industry for protection from flash fires or short-duration thermal exposures. The fabric, however, can be stiffer than other fabrics, which can limit the movement of the wearer, and it is often more expensive than other technologies. Moreover, when exposed to extreme heat, the fibers can shrink, which decreases the space between the skin and the FR protection and can result in severe burns.

GAS-STATE OR FUEL-ACTIVATED FR TECHNOLOGY

Gas-state FR technologies help to eliminate a fire's fuel by trapping radical molecules produced by the flame. When the technology is exposed to heat, molecules break down and bind to radicals the flame produces from decomposing fibers. This process reduces the fuel available to the fire and stops the flame's chain reaction, and therefore, snuffs out the flame. This technology is widely used throughout the PPE industry and is an effective method of flame-resistant technology.

KEY TAKEAWAYS

Gas-state/fuel-activated FR technologies are soft, easy to dye, retain their color and when cared for according to the maintenance tag, can be laundered without compromising the FR properties. Additionally, because the FR protection occurs above the fabric as opposed to on the surface of the fabric, these fibers can be blended with non-FR fibers, allowing the technology to be available at a lower price point. However, these fabrics can often have a slightly lower durability threshold and can shrink more than other technologies. The electrical industry primarily utilizes this technology to help protect against arc flashes. Additionally, it can be found in everyday items such as televisions and mattresses. Gas-state FR technologies can also be blended with other FR technologies to achieve dual-hazard protection for FR/AR hazards.

While the engineering behind FR technologies is complex, choosing the ideal fabric for your FR PPE program does not have to be. The type of fabric should be the main consideration when specifying FR/AR garments. Choosing a trusted brand that creates FR fabrics designed to protect against your specific industry hazards is essential to creating a safer environment for employees. Not all FR fabrics are designed to protect against all short-term thermal exposures, like arc flash and flash fire. When selecting your FR garments, it is important to understand what hazards you need to protect against and ask how an FR fabric does so.

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