How Stahl’s water-based flame retardants enable safe and more sustainable performance coatings and binders

By John Friddle,
Business Manager - Eagle Flame Retardants, Stahl

A lot of materials we use in everyday life, such as plastics and textiles, consist of organic polymers. Those are flammable and present a fire risk. Product safety and sustainability are both of the utmost importance within Stahl. That is why we decided to combine the best of both worlds. Stahl’s flame retardant technology is water-based and has been designed to meet the environmental profile of an evolving world. We offer a complete range of flame retardants for coatings and finishes. In this technical article, John Friddle, Business Manager - Eagle Flame Retardants at Stahl explains how the technology works and its benefits.

How it works
To reduce the fire risk, flame retardants either inhibit the possibility of the materials igniting or reduce the rate of spreading the flames. For materials to ignite, it requires oxygen in the gas phase oxidation process. So it first degrades to evolve to combustible compounds which can mix with oxygen and then fuel a flame. Flame retardants transfer the heat to the material surface to cause further degradation, to establish a self-sustaining combustion cycle.

The diagram below specifies the combustion cycle with potential flame retardation modes. One can either influence the heat barrier, the chemistry or the flames can be extinguished. Flame retardants may function in one or more of these modes.

- Heat barrier mechanisms (a) either remove heat or prevent heat from returning to the polymer. Think of those flame retardants that have high heats of fusion, degradation and/or dehydration. Intumescent fire-retardants are another fine example. The secret lies in the formation of a glassy surface which in turn will take on a role as a heat barrier, thus protecting the underlying textile substrate.

- Another flame retardant mechanism is all about modifying the chemistry by increasing char formation on one hand or by reducing the combustible volatiles on the other. Char formation is in order for most flame retardants containing phosphor or nitrogen. In common thermoplastics char formation is rather difficult to achieve.

- In mechanism (c) it’s about the best way to extinguish the flame, either by chain breakers or flame dilution. So the spread of fire is prevented by one of the two options. Breaking the flame chain reaction is particularly powerful, which is a mechanism that is easily applicable in textile coating and back-coatings. Flame dilutions works with taking away or physically diluting the reaction species present.

![Schematic diagram of the polymer combustion cycle with potential flame retardation modes indicated in italics (Price and Horrocks, 2010).](image-url)
Method & testing
Stahl's dedicated R&D center for Flame Retardants in Calhoun, United States, focuses on innovations. Special machines combined with our expertise ensure top-class end products. We use a variety of flame test equipment to measure the following: heat release, destroyed fabric, smoke and toxicity. Untreated fabrics may meet the most passive test standards by their physical nature. However, to meet the standards of critical usages such as in cars, aviation or public buildings, these fabrics need certain chemistry to meet these safety driven demands. The test equipment used by our trained personnel provides data and physical evidence to ensure materials will not only pass specific codes, but will perform in a safe manner.

Application
Stahl offers a complete range of flame retardants for coatings and finishes. These flame retardants are used in a variety of industries such as Aviation (e.g. for aircraft seats and carpeting), Automotive (e.g. for car upholstery, safety belts, carpet and filters), Industrial Applications (e.g. for foils, backpacks and fiberglass), Apparel & Accessories (e.g. for fashion items) and Home Interior (e.g. for curtains, roofing, awnings and upholstery).

Extensive benefits
The benefits of using our flame retardants are substantial. They guarantee a high level of safety as Stahl chooses the best chemistry to provide safety in case of a fire, but also remain safe for daily use during the life of the product and the end of the products life. Furthermore, our flame retardants are durable as they are mainly water-based instead of solvent-based.

Stahl's sustainability agenda
The current demands for flame retardants having higher levels of sustainability require the use of halogens and phosphorus flame retardants are carefully managed and that newer chemical developments fall within regulatory frameworks like REACh (the European Community Regulation on Chemicals and Their Safe Use, EC 1907/2006). Stahl's flame retardant technology is mainly water-based and has been designed to meet the environmental profile of an evolving world. All our products of this technology range are not only REACh compliant, but go beyond these guidelines to be one step ahead of future possible restrictions.

References

Contact information
For more information about this technical article or the solutions of Stahl, please contact:
John Friddle
Business Manager - Eagle Flame Retardants
+1 770-547-0005
john.friddle@stahl.com
www.stahl.com