



# HEALTHY STUFF

Researching toxic chemicals in everyday products

## WHAT'S THE DIFFERENCE?

### Polymeric, Additive, and Reactive Flame Retardant Chemicals

Flame retardant (FR) chemicals are added to products to slow the rate of flame spread or the rate of ignition. FRs are a relatively inexpensive way to meet flammability requirements for items such as children's car seats, fire-protective clothing, electronic devices & appliances, and vehicles & airplanes.

FRs have a wide variety of chemical structures and ways of being incorporated into products. This guide defines the terms and explains the general differences between additive FRs (including polymeric FRs) and reactive FRs.

### POLYMER DEFINITIONS

Most products to which FRs are applied are made of polymer materials, such as the fabrics and cushioning foam in car seats.

A **polymer** is a large molecule with a repeating unit called a **monomer**. Monomers link up to form chains or networks. One polymer chain might have hundreds or thousands of monomers.

A **synthetic** polymer indicates a material not found in nature. Synthetic polymers are commonly called **plastics**. Familiar synthetic polymer items include polyester fleece, nylon stockings, and silicone toys.

Naturally occurring polymers include cellulose--the main component of cotton and wood--and DNA.

### ADDITIVE VS. REACTIVE

**Additive FRs** are blended with or coated on materials to make them flame resistant. They can be small or large molecules--and can even be polymers themselves.

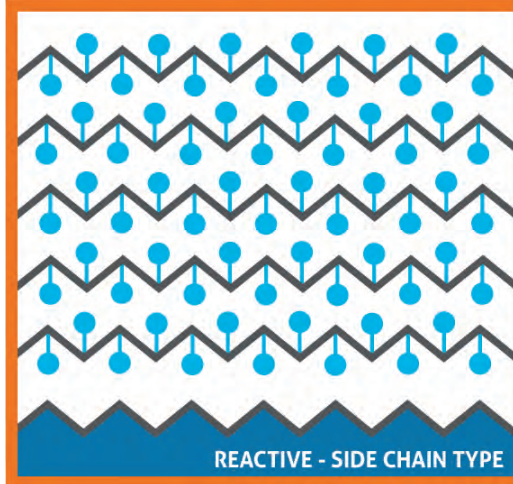
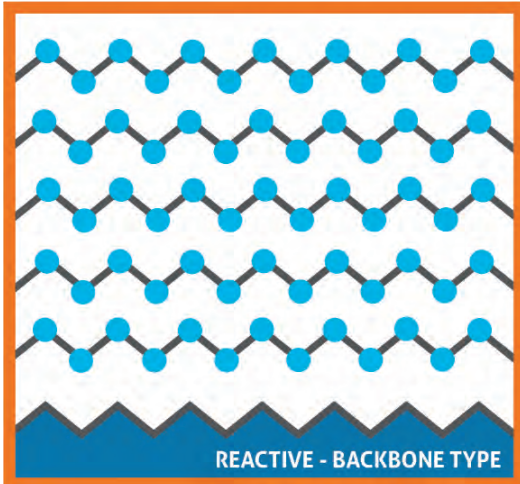
**Small molecule additive FRs** can easily migrate out of the material and may transfer to dust, clothing, and skin.

**Polymeric additive FRs** are less likely to migrate out due to the larger size of the molecule. Oligomeric FRs (shorter polymer chains; exact definitions vary) also fall in this category.

**Reactive FRs** become bound to a polymer material by a chemical reaction when the material is being created. The finished material thus contains a built-in flame retardant that cannot easily migrate out like the more weakly bound additive FRs. Some product makers refer to materials containing reactive FR as "inherently flame retardant."

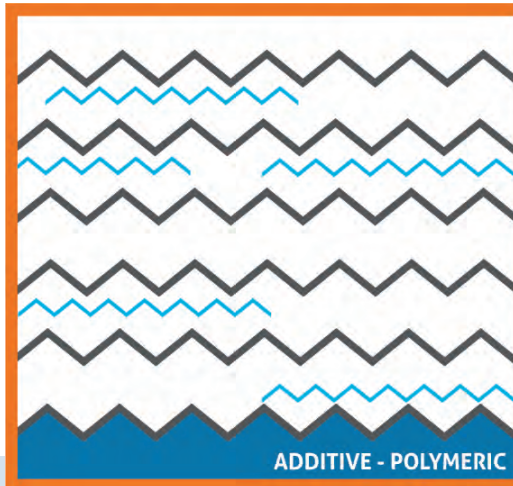
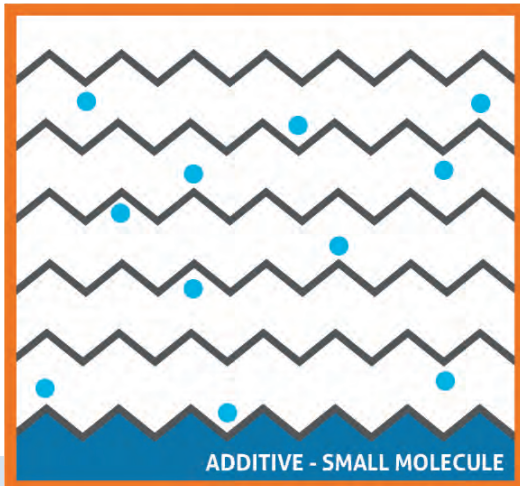
Reactive FRs can be **side-chain** or **backbone type**, in which the FR chemical is attached either as an appendage along the polymer chain or as part of its "backbone," respectively.

# SIMPLIFIED FR SCHEMATICS



Gray lines represent the polymer chains of the material to which an FR is applied.

Blue dots or lines represent FR chemicals.



## Examples of products that may contain FRs

- airplane, train and bus seats (reactive or additive)
- children's car seats (reactive or additive)
- children's polyester pajamas (reactive)
- cotton or polyester safety garments (reactive or additive)
- electronic devices and appliances (reactive or additive)
- firefighter suits (reactive or additive)
- flight attendant uniforms (reactive or additive)
- foam board insulation (additive)
- hospital curtains (reactive or additive)
- mattresses (reactive or additive)
- outdoor gear such as tents (reactive or additive)