

U.S. Fire Administration / National Fire Academy

*Coffee Break Training***Topic: Plastics (Part V: Expanded and Unexpanded Plastics)**

Learning Objective: The student shall be able to explain the difference between expanded and unexpanded plastics.

The plastics-making process includes a series of important steps. Crude oil and natural gas are refined into ethane, propane, and hundreds of other petrochemical products. Using high-temperature furnaces, ethane and propane are “cracked” into ethylene and propylene.

Then, a catalyst is combined with ethylene or propylene in a reactor, resulting in a powdered polymer. The polymer is combined with additives in a continuous blender, extruded, and then melted. The plastic is cooled and then fed to a pelletizer that cuts the product into small pellets. The pellets are used in processes such as extrusion, injection molding, and blow molding to make millions of plastic products.

Plastics may be *expanded* or *unexpanded*. Expanded plastics are created when the plastic beads are placed into a mold, and a blowing agent or gas—usually pentane—is dissolved in the plastic. The closed mold is heated to soften the plastic, and the gas expands, or a blowing agent generates gas. The result is a fused, closed-cell structure of foamed plastic that conforms to a shape, such as expanded polystyrene cups. Styrofoam™ expanded polystyrene is made in a continuous extrusion process using expanded bead blowing.

Unexpanded plastics are made into films or sheets for other products ranging from windows to computer cases to aircraft parts. Unexpanded plastics can be cast or thermoformed. Casting is where molten resins are poured into a mold in the shape of the desired product. Thermoforming occurs when thermoplastic films are heated to soften the film, and then the soft film is pulled by vacuum or pushed by pressure to conform to a mold or pressed with a plug into a mold.

Expanded plastics tend to be more combustible than unexpanded plastics due to the increased surface area of the expanded plastic, the entrained air or gas in the expanded beads, and the overall lighter density of the final product. In general, when fire protection systems are designed to protect plastics, expanded plastics create a comparatively higher challenge than unexpanded plastics.

You can obtain more information about plastics from the American Plastics Council at www.plastics-info.com



Common expanded (above) and unexpanded plastics.