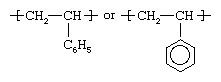
Plystrene chemical compound

a hard, stiff, brilliantly transparent synthetic [resin](http://www.britannica.com/EBchecked/topic/499227/resin) produced by the [polymerization](http://www.britannica.com/EBchecked/topic/468745/polymerization) of [styrene](http://www.britannica.com/EBchecked/topic/570368/styrene). It is widely employed in the food-service industry as rigid trays and containers, disposable eating utensils, and foamed cups, plates, and bowls. Polystyrene is also copolymerized, or blended with other [polymers](http://www.britannica.com/EBchecked/topic/468696/polymer), lending hardness and rigidity to a number of important [plastic](http://www.britannica.com/EBchecked/topic/463684/plastic) and [rubber](http://www.britannica.com/EBchecked/topic/511800/rubber) products.

Styrene is obtained by reacting [ethylene](http://www.britannica.com/EBchecked/topic/194436/ethylene) with [benzene](http://www.britannica.com/EBchecked/topic/61279/benzene) in the presence of [aluminum chloride](http://www.britannica.com/EBchecked/topic/18022/aluminum-chloride) to yield ethylbenzene. The benzene group in this compound is then dehydrogenated to yield phenylethylene, or styrene, a clear liquid [hydrocarbon](http://www.britannica.com/EBchecked/topic/278321/hydrocarbon) with the chemical structure CH2=CHC6H5. Styrene is polymerized by using free-radical initiators primarily in bulk and suspension processes, although solution and emulsion methods are also employed. The structure of the polymer repeating unit can be represented as:

The presence of the pendant phenyl (C6H5) groups is key to the properties of polystyrene. Solid polystyrene is transparent, owing to these large, ring-shaped molecular groups, which prevent the polymer chains from packing into close, crystalline arrangements. In addition, the phenyl rings restrict rotation of the chains around the [carbon](http://www.britannica.com/EBchecked/topic/94732/carbon)-carbon bonds, lending the polymer its noted rigidity.

The polymerization of styrene has been known since 1839, when German pharmacist Eduard Simon reported its conversion into a solid later named metastyrol. As late as 1930 little commercial use had been found for the polymer because of brittleness and crazing (minute cracking), which were caused by impurities that brought about the cross-linking of the polymer chains. By 1937 American chemist Robert Dreisbach and others at the [Dow Chemical Company](http://www.britannica.com/EBchecked/topic/170379/Dow-Chemical-Company)’s physics laboratory had obtained purified styrene monomer through the dehydrogenation of ethylbenzene and developed a pilot polymerization process. By 1938 polystyrene was being produced commercially. It quickly became one of the most important modern plastics, owing to the low cost of producing large volumes of styrene monomer, the ease of shaping the melted polymer in injection-molding operations, and the optical and physical properties of the material.

Polystyrene foam was formerly made with the aid of [chlorofluorocarbon](http://www.britannica.com/EBchecked/topic/113689/chlorofluorocarbon) [blowing agents](http://www.britannica.com/EBchecked/topic/70100/blowing-agent)—a class of compounds that has been banned for environmental reasons. Now foamed by pentane or [carbon dioxide](http://www.britannica.com/EBchecked/topic/94900/carbon-dioxide) gas, polystyrene is made into insulation and packaging materials as well as food containers such as beverage cups, egg cartons, and disposable plates and trays. Solid polystyrene products include injection-molded eating utensils, videocassettes and audiocassettes, and cases for audiocassettes and [compact discs](http://www.britannica.com/EBchecked/topic/129497/compact-disc). Many fresh foods are packaged in clear vacuum-formed polystyrene trays, owing to the high gas permeability and good water-vapour transmission of the material. The clear windows in many postage envelopes are made of polystyrene film. The plastic recycling code number of polystyrene is #6. Recycled polystyrene products are commonly melted down and reused in foamed insulation.

Despite its advantageous properties, polystyrene is brittle and flammable; it also softens in boiling water and, without the addition of chemical stabilizers, yellows upon prolonged exposure to sunlight. In order to reduce brittleness and improve impact strength, more than half of all polystyrene produced is blended with 5 to 10 percent [butadiene rubber](http://www.britannica.com/EBchecked/topic/86401/butadiene-rubber). This blend, suitable for toys and appliance parts, is marketed as high-impact polystyrene (HIPS)