More than half of the world's synthetic rubber is styrene-butadiene rubber (SBR). World usage of SBR is about the same as that of natural rubber: between eight and nine billion pounds of each (see Fig. 7.1 and Tables 7.1 and 7.2). The factors accounting for this dominance are economic and technological: (1) the availability of styrene and butadiene precursors in fossil hydrocarbons makes these two monomers preeminent among the possible sources of synthetic rubber, and (2) they can be combined in rubber compounds that can be processed conveniently in tire molds, where thermal treatment converts them into tires. Much of the modern world's transportation relies on these durable, tough elastic composites. In fact, the tire industry has come to depend on SBR more than on natural rubber, partly because the latter has at times been harder to get, and partly because SBR often is better for the purpose required. Similarly, other synthetic rubbers have competed on the basis of both availability and technological utility; in some cases, they have even found niches, but lesser ones. It is instructive to examine history, searching for the reasons SBR has won its dominance, especially at a time when its share of the market is declining.

HISTORICAL BACKGROUND

Shortages of natural rubber have repeatedly been the major spur for the development of synthetic rubbers. At such times, production of synthetics has been able to get established even if their properties are significantly inferior to those of the natural product. During World War I, Germany used methyl rubber, made from dimethylbutadiene, because the Allied blockade almost completely cut off the supply of natural rubber from the tropical regions where it was produced. Methyl rubber was so inadequate, given the level of compounding and tire technology of that time, that its production was dropped at war's end. In
the 1920's, the ability of emulsion systems to achieve both high production rates and high-molecular-weight products using free radical catalysts was recognized. German chemists experimented with various monomers during that decade and the next and, by the early 1930's, had developed butadiene-styrene copolymer (Buna S) and butadiene-acrylonitrile copolymer (Buna N). This was all part of a national effort to make Germany independent of foreign sources of rubber.

Similarly, the massive American effort of World War II was driven by the shortage of natural rubber and was accelerated when the Japanese took control of Asian plantation areas. The U.S. program chose the butadiene-styrene copolymer as the major synthetic rubber to replace natural. In America it was then called GR-S (Government Rubber-Styrene). The name SBR superseded GR-S after the sale of the plants to private industry in 1955. No significance remains in the order in which the monomers styrene and butadiene are named in these copolymers. SBR is a generic term covering a wide variety of rubbers differing not only in the ratio of styrene/butadiene and their content of other substances

Figure 7.1. Percent of free-world rubber supply. (Adapted from Worldwide Rubber Statistics, January 1985, International Institute of Synthetic Rubber Producers, Inc., Houston TX. Table IV, p. 13.)