CHEMISTRY

# "Cold" Rubber for Tires

## The superiority of this synthetic product to natural rubber has hastened the conversion of plants to make possible large-scale production.

➤ MAN-MADE "cold" rubber makes markedly superior tires and other products and surpasses the natural tree-grown rubber. It is now going into large-scale production in America's chemical rubber plants.

What is happening is a new chapter in creative chemistry. During the recent war scientists made rubber from petroleum. They made this nation independent of unavailable natural rubber and gave us the essential tires for military and civilian transport.

Now the famous war-time GR-S rubber is being surpassed by post-war development of low-temperature manufacture, new chemical catalysts, and superior carbon black for compounding.

The rather chilly temperature of 41 degrees Fahrenheit, just nine degrees above freezing, is being used in the major cold rubber production. The temperature at which standard GR-S rubber is made is 122 degrees Fahrenheit.

### Plants Being Converted

Over half of the operating capacity of the government-owned synthetic rubber plants, 200,000 out of 376,000 tons per year, is now in the process of being converted to cold-rubber production through installation of the refrigerating equipment necessary. Present plants do not need to be changed except to install tanks, compressors and other machinery for working at the lower temperature necessary. Eight out of the nine operating plants (all but the Akron plant) are being converted.

Glowing reports of the superior qualities of cold rubber have hastened the rush to its production. Synthetic rubber is now at least as good as the natural product, and most reports credit the low-temperature sort with being 20% to 40% better in wear. It does not heat up when tires are run at high speed any more than the natural sort, which was a fault of the older synthetic tires.

You may be getting some of the new cold rubber in tires that you buy without knowing it because tires made from it are not being labeled or advertised as such due to the present small production. In about a year most of the tires made are expected to be made with cold rubber.

Butadiene and styrene, polymerized together, are used to make cold rubber just as these two chemicals are the basic materials of the standard GR-S rubber. In polymerization, big molecules are made out of little ones. One key to low-temperature rubber production is the new sort of catalyst. In rubber technology, catalyst means an oxidizing agent that promotes polymerization and is used up in the process.

In the older synthetic rubber manufacture, potassium persulfate was used as catalyst, while in the cold rubber process cumene hydroperoxide is used. This organic peroxide was worked out in the University of Minnesota laboratories under the direction of Dr. I. M. Kolthoff and is a key ingredient of the low-temperature process, making it possible to complete the chemical reaction in a reasonable time, despite temperature.

Soap of fatty acid or rosin types is used in any kind of synthetic rubber formula in relatively large quantity to emulsify the chemicals used. More soap is used than styrene, one of the two chemicals that constitute the rubber.

In compounding the synthetic rubber into vulcanized products, such as tires, a new kind of carbon black, finely divided carbon filler for the rubber, is contributing greatly to the quality and economy of the product. This HAF or furnace black, as it is called, is made from oil or enriched natural gas.

Since synthetic rubber is a government operation growing out of the war situation, its price is controlled and set by the Office of Rubber Reserve. At present it is 18 1/2 cents a pound which compares with the current 22 1/2 cents a pound for natural rubber which is controlled by the British monopoly. Synthetic cold rubber is therefore cheaper as well as better than the natural material.

Latex rubber used in cord tire dipping, adhesives, rubber foam, textile coating, etc. is also being made by the low-temperature process with development of high gum tensile strength.

Because the synthetic rubber development is a government-industry undertaking, the cold rubber research and production is largely cooperative. Various rubber companies and research laboratories exchange information and work together.

The next step in cold rubber production will be to apply even lower temperature in hope of getting better and better quality rubber. One rubber company has made small scale polymerization at as low as 40 degrees Fahrenheit below zero, and some of this rubber has been tested in tires. Below-freezing processes are receiving fairly large scale, semi-commercial trials, with 14 degrees and 0 degrees as the temperatures being used. When subfreezing levels are encountered, anti-freeze must be used in the water used, just as in automobile radiators. This complicates the process. The lower temperatures also require more refrigeration.

Cold rubber promises to withstand better the arctic temperatures that trucks and other equipment must encounter in case of another war. Rubber made at 41 degrees also does not crack as easily as ordinary rubber.

### Low-Temperature Rubber

Hints of the possibility of low-temperature rubber production antedate the government rubber program that began in 1940. It was early recognized that low-temperature polymerization would produce rubber of better quality, but the 122-degree temperature was adopted because the emergency was great and the standard process gave known results with the reaction running 14 hours. During the war the "speed-up" chemicals increasing the polymerization rates at low temperatures were developed, and German experience with low temperature rubber recipes became known. With the end of the war, the effort to improve the process could be resumed. The use of what is called the "redox" system, involving oxidizing ("catalysts") and reducing agents, was refined and ap-

*500 TIMES BRIGHTER—The large electronic tube shown here is the first working model of the X-ray "telescope" which will brighten by 500 times the living image viewed by the doctor on the screen of the X-ray fluoroscope. Westinghouse scientist Dr. Richard L. Longini is shown closing the doors of a special electric furnace in which the tube will be baked and evacuated of air.*