CHEMISTRY

"Glass" from Coal

Natural Gas or Oil Also Used With Water and Air To Make Clear Transparent Plastics for New Uses

By WATSON DAVIS

See Front Cover

"GLASS" made from coal or natural gas or oil, water and air. Transparent stuffs of a new sort that rival and surpass in some respects ordinary glass, conventionally the transparent material for thousands of years.

Organic glass, plastics or synthetic resin, that can be used for jewelry, window panes, dishes, boxes you can see through, even eyeglasses, lenses for cameras and new medical aids. Lighter, less brittle, more flexible than the familiar glass made from sand.

Promising new materials for tomorrow are these new kinds of chemical "glass" which are first cousin to the more familiar and usually opaque plastics and resins used in increasing quantities for radio cabinets, automobile parts, and thousands of other things for daily living.

Acrylic resins, vinyl resins, polystyrene, these newer transparent synthetics are called. You'd better learn at least their family names because they are sure to cut quite a swath in chemical society.

Useful as synthetic "glasses" also are older chemical resins, longer used in industry, that now have acquired greater transparency, thanks to research. The granddaddy of synthetic resins, born of two disinfectants, phenol and formaldehyde, and its later variant made of urea and formaldehyde, can be made white and transparent. There are also cellulose compounds made from wood and cotton that have become very common and rank with glass in some utilizations.

One You Should Know

Particularly you should know polymethyl methacrylate, which goes into commerce here and abroad under a long list of trade names. This resin is the most transparent and most promising of the newer kinds of colorless synthetic resin glass competitors, the one most widely used so far. Lucite is what du Pont calls it, while Röhm & Haas label it Plexiglas and Crystalite.

So clear, water-white and brilliant is polymethyl methacrylate that one of its principal exhibition pieces consists of a huge "diamond" that would weigh some 57,000 carats if it were really carbon crystal instead of the chemical synthetic. You may have seen it at the two world's fairs, and mistaken it for glass. You can tell it from glass by its complete freedom from color and perfect transparency. It is being used in signs and displays, in airplane and bus windows, and in transparent models. The famous transparent automobile has this synthetic resin for its outer coating.

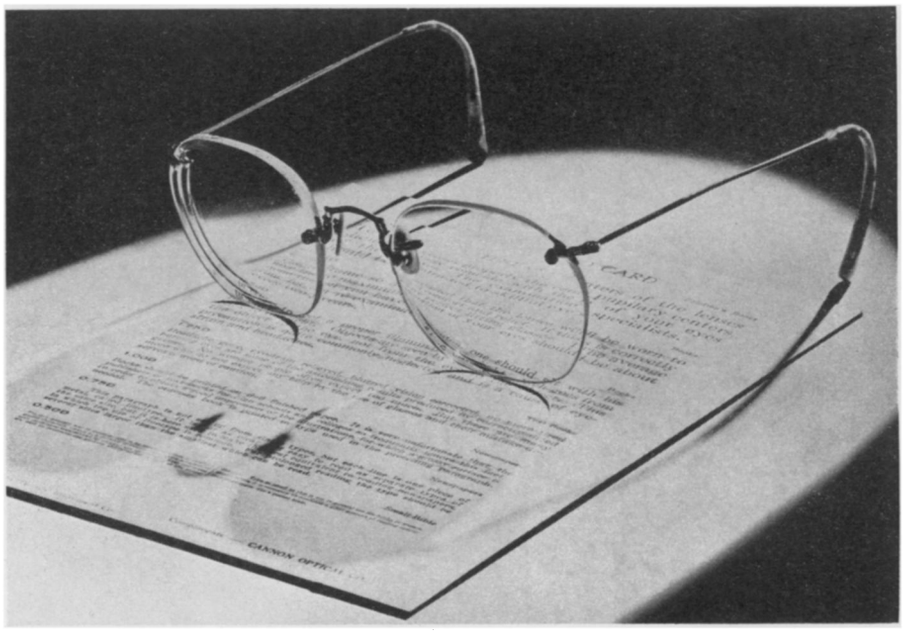
Clearer than optical glass, it weighs half as much. As it is not easily shattered one of its first optical uses is in safety goggles. Ordinary eyeglasses, especially for playful children, can be made from this novel material, which can be ground and polished like glass. Standard shaped lenses can be molded to exact size without costly finishing. A related use is for making the reflectors that line and mark the edge of highways.

These Stimson reflectors present a myriad of facets, formed by protrusions, each of which is a corner of a cube. Polymethyl methacrylate is suitable for the manufacture of these reflectors because it can be molded with the extreme accuracy requisite to effective reflection, and because it will tolerate prolonged exposure to rain and sunshine.

New Jobs

The acrylic resins do some jobs that glass cannot do. They have the happy property of total internal reflection, unpossessed by ordinary glass, one of the features of fused quartz that makes it valuable. This means that it can be used to "pipe" light, pouring it around corners of a rod of the resin. It has made possible new surgical accessories useful in medical practice and dentistry, rods that deliver light to inconvenient places in the mouth and other human anatomical locations. It allows the production of novel effects in illuminated display signs.

An S-bar of plastic showing dramatically how it "pipes" light appears on the front cover of this week's SCIENCE NEWS LETTER. The photograph is by Fremont Davis, Science Service staff photographer.



HARD TO BREAK

Valuable and important use of the new transparent plastics, created in chemical laboratories, is in low-cost spectacles whose lenses are made by molding rather than by costly grinding. Such spectacles have been suggested for school children too poor to afford the ordinary kind.

"GLASS" CAR

An exhibition motor car whose body is made entirely of transparent plastic provides a striking World's Fair demonstration for both the automotive and the plastics industry. The demonstrator examining the tire can see his wrist watch through the clear fender.

Polystyrene is another "organic glass" that is clear, transparent, and resistant to alcohol, many acids, and water. It consists of a long chain of molecules made up of carbon and hydrogen. Although it is only now coming into commercial use, it is called the "oldest synthetic organic plastic" because styrene was first produced nearly a hundred years ago and was thus one of the early organic compounds to be synthesized. Styrene is a colorless liquid that when heated or exposed to light thickens and becomes finally a hard, transparent substance, called polystyrene. Styron is the trade name of the Dow Chemical Company polystyrene, and it is also sold under the inclusive Bakelite label.

New Filling

The most modern filling in the glass sandwich that makes safety glass for auto windshields and windows is one of the other plastics, polyvinyl butyral. The old material used as a film in the center of laminated glass was cellulose nitrate and cellulose acetate, but these have the disadvantage of getting brittle in cold weather and not being too permanent. The newer vinyl resin, mixed with a considerable proportion of an appropriate plasticizer, is an almost ideal safety glass plastic, remaining non-brittle at all times, even in cold weather. It prevents flying of broken glass fragments and needs no sealing around the edges for weather protection. Vinyl resins also give promise of usefulness in transparent sheets and other forms. Vinylite is the trade name given vinyl resin by Carbide and Carbon Chemicals Corporation, while the du Pont label is Butacite, and Shawinigan Products Corporation names them Alvar, Butvar, Formvar and Gelva.

You will notice that "poly" appears in the chemical names of many of these and other synthetic resins. Meaning "many," it refers to the joining of many identical molecules to make the useful compounds. Many molecules of the substance string along together, joining chemical hands. This process is called by the chemist, polymerization. And the products formed are polymers. Practically all the newer transparent synthetic "glasses" are polymers.

Carbon, hydrogen and oxygen are the elemental building blocks used in the chemical construction of most of these synthetic materials. Of course, these are among the atoms used in building all organic substances. The raw materials used in the manufacture of the synthetic resins are relatively cheaply made chemicals obtained from coal, gas and petroleum, useful as rich chemical storehouses as well as fuels. Air and water join in the chemical synthesis often, as they do in almost everything else in the organic world.

One of the Wonders

One of the wonders of modern chemistry is that it is possible to build up almost any organic compound from such cheap, plentiful substances. For instance, ethylene obtainable from petroleum is a starting point for the acrylic resins, vinyl resins, and polystyrene.

The older and original commercially successful synthetic resin, made of carbolic acid (phenol) and formaldehyde, invented by Dr. Leo H. Baekeland, is usually opaque brown in color. It can now be made approximately water-white and transparent, as well as in various colors. It also can be called a synthetic "glass." There are also transparent urea-formaldehyde resins.

Several other plastics, notably cellulose nitrate (pyroxylin) and cellulose acetate, familiar as base for photograph film, are transparent. But they are not sufficiently hard and lack other properties that would allow them to compete with glass. Both of these are made from the cellulose in wood or cotton. So also is a similar material that has come into more recent use, ethyl cellulose. These are more likely to be met with as films and coatings competing with paper, cloth and even paint rather than with glass.

Plastics take their place as common materials for industry and home alongside wood, metal, concrete, paper, cloth, and other familiar things.

In the cities of tomorrow the houses will have transparent wall panels where desired. They will be molded or cast of new synthetic "glass" resin. Furniture of the future can be transparent but non-shatterable. Artists have a new material with which to work. Machinery that needs watching can have plastic housing that can be seen through. Imagine the uses of a "glass" as unbreakable as wood. Chemistry is making it a lighter, brighter world in which to live.

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MEDICINE

Hay Fever Victims Warned Against Severe Chilling

JUST in time for the late summer and early fall hay-fever season comes a warning to sufferers to guard against getting chilled, either by cooling breezes on a motor trip, an electric fan or super-cold air-conditioned theaters, restaurants and the like. The warning, by a hay-fever authority, Dr. Harry S. Bernton of Washington, D. C., appears in a new book, Hay-Fever—What To Do About It (Ransdell).

Hay-fever victims suffer from allergy which means "altered reactivity," Dr. Bernton explains. Their reactivity is altered not only toward the particular pollens which make them sniffle and sneeze but also toward temperature changes. Their heat-regulating mechanism is deranged. One victim described it by saying his "thermostat was out of order."

The cool breezes of an electric fan, the chilled air of a theater or train in summer, may make the normal person sneeze merely once or twice, but it is sure, in Dr. Bernton's opinion, to bring on a bad attack of hay-fever in the allergic person. The chilling constricts the blood vessels of the skin, driving the blood into other parts of the body, including the tissues of the nasal cavities. The consequent swelling of these tissues provokes and accentuates the trouble the hay-fever sufferer is already having with his nose.

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