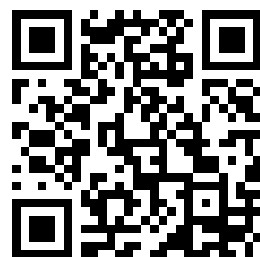

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Plastics and Adhesives: A Guide to Their Physical Properties and Uses

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NOTS 1335

PLASTICS AND ADHESIVES: A GUIDE TO
THEIR PHYSICAL PROPERTIES
AND USES

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and
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Propellants and Explosives Department

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Part I: Plastics

CELLULOSE PLASTICS. The only important cellulose plastics for applications where transparency is a factor are the acetate and cellophane, the latter being essentially the sheet form of viscose rayon. The properties and uses of cellophane are too well known to warrant any comment here except to correct the widely held belief that all cellophane can be heat-sealed. Cellophane itself is not thermoplastic, and so will not melt when heated--however, a fusible coating is sometimes applied to the surface to impart heat-sealability. Other transparent heat-sealable films are frequently mistaken for cellophane.

Nitrate is still used to some extent as negative film in the motion picture industry, but it is being displaced by acetate in many film applications. By far the greatest application of cellulose plastic sheet and film is in photography; but appreciable quantities are used as a parting agent in polyester laminates, as material for packaging and for drafting instruments, and as wire-reinforced sheet for greenhouses.

Cellulose acetate sheet is a particularly good transmitter of ultra-violet light--a property which accounts for its use in greenhouses. It has good dimensional stability and can be made stiff without brittleness--a property important in photographic film. It does not stand sunlight very well, nor are its chemical or electrical properties more than fair. Cellulose acetate is sold as Kodapod sheet, Plastacele, and Tenite.

RUBBER HYDROCHLORIDE. Rubber hydrochloride, under the name of Pliofilm, comes in thicknesses from 0.001 to 0.003 inch. It is used almost exclusively in packaging foods, particularly meat. Pliofilm is a tough, rubbery film which has low moisture-vapor permeability and is easily heat-sealed.

VINYL AND POLYETHYLENE FILMS. Vinyl and polyethylene films are produced in enormous quantities. The vinyls are generally more flexible than the polyethylenes for a given thickness, and have better heat resistance. Polyethylene is finding increasing use in packaging, especially as drum liners. Much of it is also used as a dielectric in a number of electrical applications.

POLYESTER. The newest and most remarkable film to appear recently is a polyester film, specifically polyethylene terephthalate, or Mylar. It is characterized by high tensile strength and by the highest tear strength of any film. It is the

film form of the fiber Dacron. Mylar is used as electrical insulation, as sound-recording tape, and, in some instances, as material for packaging.

Fluorinated Hydrocarbons

KINDS. Of the fluorinated hydrocarbon plastics (hydrocarbon plastics treated with the element fluorine), there are now two kinds: polymonochlorotrifluoroethylene, marketed as Kel-F by the M. W. Kellogg Company, and polytetrafluoroethylene, marketed as Teflon by Dupont. Kel-F contains chlorine as well as fluorine.

Teflon and Kel-F have very similar physical and chemical properties, but there are some differences. In general, Teflon has greater chemical and heat resistance and a much better power factor at high frequencies. Kel-F, on the other hand, is much easier to work on conventional equipment, and may be plasticized, with Kel-F oils of molecular-weight lower than its own, without seriously harming its chemical inertness. The price of Kel-F is about twice that of Teflon. The properties of the two compounds, as has been indicated, are comparable, but inasmuch as Teflon is the more difficult to process, it will be selected for special attention.

APPLICATIONS OF TEFLON. Teflon is a remarkable material, with several unusual properties. It has the highest degree of chemical inertness of any commercial plastic, has zero water absorption, is unaffected by outdoor weathering, maintains its strength over a temperature range from -90 to 500° F, and has excellent dielectric properties over a wide range of temperatures and frequencies. Against these favorable qualities must be placed its high cost, the necessity for special molding techniques in its use, and the impossibility of sticking anything to it. It is an unusual material for unusual jobs.

Teflon is used mostly for gaskets and packing under very corrosive conditions and high temperatures, and for electrical applications where high temperatures and high dielectric properties are required.