

# DOWNLOAD PDF PERMEABILITY AND OTHER FILM PROPERTIES OF PLASTICS AND ELASTOMERS.

Chapter 1 : permeability properties of plastics and elastomers | Download eBook pdf, epub, tuebl, mobi

*Permeability and Other Film Properties of Plastics and Elastomers [William Woishnis] on www.nxgvision.com \*FREE\* shipping on qualifying offers. This is the only data handbook on the barrier and film properties of polymeric materials in thin sections.*

The materials of packaging continue to become better and stronger. The next packaging milestone is just around the corner. These test methods are also used internationally. The following ASTM testing descriptions are some of the most common test methods used for the films discussed in this publication. For full test details, please review the appropriate testing references. Primary Film Test Method: The primary test method, ASTM D, is used for the determination of tensile properties of plastics in the form of thin sheeting less than 1. This includes film which has been arbitrarily defined as sheeting having nominal thickness not greater than 0. Tensile strength refers to the maximum stress the film can sustain before it actually fractures; quite literally, the amount of force necessary to pull a material apart. The SI unit of tensile strength is the pascal English units are pounds per inch of original cross-sectional area. Elongation refers to the amount the material will stretch before breaking. Introduction 4 Tensile modulus is a measure of the force required to deform the film by a specific amount. The following material properties can be calculated from the tensile strength test at yield and at break: I S 0 A weighted dart is dropped from a standard height onto a taut sample. Depending upon the expected impact strength of the test sample, either method A or method B is chosen. The method defines the dart size and the drop height for the dart. Test method A specifies a dart with a 38 mm diameter dropped from 0. Test method B specifies a dart with a 5 1 mm diameter dropped from 1. The dart unit is the weight of dart in grams that breaks the sample fifty percent of the time, also called failure weight. Pendulum Impact Resistance of Plastic Film. Sometimes called Spencer Impact, ASTM D covers the determination of resistance of film to impact-puncture penetration at ambient temperatures. Tear resistance measures the ultimate force required to initiate tearing in a film or sheet, as measured in newtons. The specimen is die cut from a sheet or film. The shape of the specimen produces a stress concentration in a small area of the specimen. The maximum stress, usually found near the outset of tearing, is recorded as the tear resistance. Tear strength is the force necessary to continue tearing a sample after a nick has been made; it is reported in grams. A pendulum is released from a raised position, and a scale registers the arc through which the released pendulum swings. Samples of film are clamped into the tester and nicked to start the tear; then the pendulum is released. This tears the sample and the scale registers the arc. As the arc is proportional to the tear strength of the sample, calibration of the arc gives the tear strength. This sample provides a constant radius from the start of the tear strength measurement-useful for materials where the tear may not propagate directly up the sample as intended. Thus, only results for samples of the same thickness can be compared. High tear values may be needed for machine operations or for package strength. However, low tear values are necessary and useful for easy opening of some package types. The coefficient of friction CoF test is used to measure the static starting and kinetic sliding resistance of the film when sliding over another surface, either film-to-film or film-to-metal. Coefficient of friction is the ratio of the frictional force to the force, usually gravitational, acting perpendicular to the two surfaces in contact. The static CoF is representative of the force required to begin movement of the surfaces relative to each other. The kinetic CoF is representative of the force required to sustain this movement. The primary test method for the determination of water-vapor transmission through plastics less than 32 mm thick is ASTM E There are two basic methods; the Desiccant Method and the Water Method. Agreement between the two methods should not be expected. The method selected should be the one which most nearly approaches the conditions of use. A desiccant covered by the film to be tested and placed in a humid chamber. Moisture from the chamber permeates the film and is picked up by the desiccant. After a measured period of time the test dish is reweighed and the water vapor transmission rate WVTR of the material is calculated. A cup is filled with distilled water and covered with the plastic film. Vapor loss through

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the test sample is determined through periodic weight-loss measurements. The frictional force is measured by a stream gauge. The folding endurance test is used for determining the folding endurance of paper and plastic by use of the M. Bursting Strength of Paper. The test 0 Plastics Design Library Figure 4. The WVTR is significant for packaging a product which must be prevented either from drying out or from picking up moisture from the surrounding atmosphere. The WVTR, the permeance of the film to water vapor, and the water vapor permeability coefficient may be determined from this test. Gas transmission rate GTR Permeance Permeability Specially constructed cells are used to measure the gas transmission rate. After a film sample has been clamped into a cell, test gas is flushed through chambers on both sides of the sample. Test gas is admitted to one side of the sample; the test chamber on the other side is evacuated, and gas is allowed to permeate through the film sample into the evacuated chamber for a measured length of time. Using the geometry of the cell and film sample, with the measured pressure and temperature of the test gas which permeated the sample, the GTR can be calculated. Specular Gloss is a measure of the light reflected by the surface of a plastic film. ASTM D provides three separate gloss angles: Light is shown onto the sample at a specified angle. The fraction of the original light that is reflected onto the photosensitive receptor is called gloss. Gloss can also be affected by environmental factors such as weathering or surface abrasion. Thus, gloss can be useful in product and process development and end-use performance testing. Luminous transmittance measures the amount of light that passes through a sample. The index of refraction is the ratio of the velocity of light in a vacuum to the velocity of light in a transparent material. A sample about 6. Generally, the refractometer will provide a digital representation of the refractive index. The haze of transparent packaging materials is measured on a special haze meter where the sample is placed between an incandescent light source and geometrically arranged photocells. The amount of light transmitted by the sample, the light scattered by the sample and the instrument, and the total incident light are measured. From these values the percentage of transmitted light that is scattered can be calculated. The haze meter measures these variables and interrelates them so that the percentage of scattered light can be read on the meter. Haze can also be a result of environmental factors such as weathering or surface abrasion. Dielectric strength is expressed as volts per unit thickness and represents the maximum voltage required to produce a dielectric breakdown through the material. To test for the breakdown voltage, voltage is applied across two electrodes and increased from zero until electrical burn-through punctures the sample, or decomposition occurs. The ability of an insulator to store electrical energy can be measured through the dielectric constant, which is the ratio of the capacitance induced by two metallic plates with a film sample between them to the capacitance of the same plates with air or a vacuum between them. Better insulating materials have lower dielectric constants. Higher dielectric constants are used when high capacitance is needed. The sample is placed between two metallic plates and capacitance is measured. A second test is made without the specimen between the two electrodes. The ratio of these two values is the dielectric constant. The test method ASTM D covers directcurrent DC procedures for the determination of insulation resistance, volume resistance, volume resistivity, surface resistance, and surface resistivity of electrical insulating materials, or the corresponding conductances and conductivities. Surface resistivity ohms per square is the resistance to leakage current along the surface of an insulating material. Volume resistivity ohms-cm is the resistance to leakage current through the body of an insulating material. Also, the material is less conductive. The resistance is measured and resistivity is calculated. The units are as varied as testing; in fact, some tests provide for the use of SI and English units. Where a source document presented units other than SI, the units were converted and are presented with SI units. Extensive references are included for the user who is interested in more information about the specific materials. With respect to this data compilation, the base units for the SI system include: Many sources are available to convert from English to SI units. Many manufacturers provide a 21 CFR statement for their materials. Packaging films are primarily evaluated for food contact. Within the 21 CFR, the factors that affect food contact status include the following: Conditions of use food type, time and temperature of contact Compliance requirements concentration limitation, physical properties, extraction tests, etc. USP has general requirements for containers

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and some specific tests for containers made from certain materials; European Pharmacopoeia has some specifications for materials. In both cases, in relation to materials, the listings are intended to characterize similar materials. In neither case do the listings indicate suitability for specific drug products. Barex acts as a chemically resistant, anti-scalping layer and as the heat-seal layer in packaging.

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## Chapter 2 : Permeability and Other Film Properties of Plastics and Elastomers - PDF Free Download

*This extensively revised and updated second edition of the only data handbook available on the properties of commercial polymeric films details the permeability characteristics of over major plastic and elastomer packaging materials.*

Care should be taken, when converting, to account for Me factor. The conversion factor  $b$   $q_{pl}$  Cable only H the Rkn thickness is  $l_{mowq}$  multiply the vatwfactor product by the  $n_{lm}$   $t_{Mcknesa}$  N in mm. UnN of prewre e. The conversion factor is applicable only H the pressure dmerentiel  $I_s$   $l_{olown}$ ;  $d_{Mde}$  the value-factor product by the pressure in  $afm$ . The orlglnal unit has a factor comprising a real number with a positive power of magnlhrde, which is  $k_{rcorrect}$ . The power of magnitude should be negative. The  $m$   $m$   $h$  factor has been revised to account for this error. ABS nylon alloy See acrylonitrile butadiene styrene polymer nylon alloy. Also called ABS nylon alloy. Used in automotive applications. ABS resin See acrylonitrile butadiene styrene polymer. Also called accelerant, promoter, cocatalyst. Acetals have high impact strength and stiffness, low friction coefficient and permeability, good dimensional stability and dielectric properties, and high fatigue strength and thermal stability. Acetals have poor acid and UV resistance and are flammable. Processed by injection and blow molding and extrusion. Used in mechanical parts such as gears and bearings, automotive components, appliances, and plumbing and electronic applications. Acetone dissolves most thermoplastics and some thermosets. Used as organic synthesis intermediate, e. Also called dimethyl ketone, 2-propanone. ASA has good heat and chemical resistance, toughness, rigidity, and antistatic properties. Processed by extrusion, thermoforming, and molding. Used in construction, leisure, and automotive applications such as siding, exterior auto trim, and outdoor furniture. Acrylic resins have good optical clarity, weatherability, surface hardness, chemical resistance, rigidity, impact strength, and dimensional stability. They have poor solvent resistance, resistance to stress cracking, flexibility, and thermal stability. Processed by casting, extrusion, injection molding, and thermoforming. Used in transparent parts, auto trim, household items, light fixtures, and medical devices. They have high impact resistance, toughness, rigidity and processability, but low dielectric strength, continuous service temperature, and elongation. Outdoor use requires protective coatings in some cases. Plating grades provide excellent adhesion to metals. Processed by extrusion, blow molding, thermoforming, calendaring and injection molding. Used in household appliances, tools, nonfood packaging, business machinery, interior automotive parts, extruded sheet, pipe and pipe fittings. Has good gas barrier properties and chemical resistance. Processed by extrusion, injection molding, and thermoforming. Used in food packaging. Alcohols are produced synthetically from petroleum stock, e. The alcohols are divided in the following groups: Used in organic synthesis, as solvents, plasticizers, fuels, beverages, detergents, etc. Produced by condensation of hexamethylene diamine, isophthalic and terephthalic acid. The specimen is evaluated by comparing to a calibrated template to determine the minimum elongation at which cracking occurred. Used as an intermediate in organic synthesis, mainly in the manufacture of anthraquinone dyes and pigments. One method of preparation is by condensation of 1,4-naphthaquinone with butadiene. Antioxidants act by terminating chain-propagating free radicals or by decomposing peroxides, formed during oxidation, into stable products. The first group of antioxidants include hindered phenols and amines; the second - sulfur compounds such as thiols. Argon is often used to characterize permeability of polymeric films, as carrier gas in gas chromatography, as inert gas shield in welding, in electric bulbs such as neon, lasers and as a process environment. Has higher heat distortion temperature than regular polycarbonate. They are tough with somewhat low chemical resistance. Processed by injection and blow molding, extrusion, and thermoforming. Used in automotive housings and trim, electrical wire jacketing, printed circuit boards, and appliance enclosures. ASA See acrylate styrene acrylonitrile polymer. The method provides for the calculation of thermal transmission properties based on the flux measurements. The measurements are carried out without heat flux reference standards on a variety of solids under different environmental conditions. The apparatus

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consists of the top and bottom isothermal cold plates with an isothermal heater placed between them, and two specimens placed between the cold plates and the heater, all enclosed in an insulated chamber. The heater has a metered heating core area surrounded by a primary guard. Two basic methods, the Desiccant Method and the Water Method are used. The specimens have either one side wetted or one side exposed to high humidity and another to low humidity. In the Desiccant Method, the specimen is placed air-tight on a test dish with a desiccant that is weighed to determine the gain of weight due to water vapor transmission. In the Water Method, the water is placed in the dish that is weighed to determine the loss of water due to evaporation through the specimen. ASTM D An American Society for Testing of Materials ASTM standard method for determination of the resistance to breakage by flexural shock of plastics and electrical insulating materials, as indicated by the energy extracted from standard pendulum-type hammers in breaking standard specimens with one pendulum swing. The hammers are mounted on standard machines of either Izod or Charpy type. Impact properties determined include Izod or Charpy impact energy normalized per width of the specimen. See also impact energy. ASTM D An American Society for Testing of Materials ASTM standard methods for determining tensile strength, tensile stress, ultimate elongation, tensile set and set after break of rubber at low, ambient and elevated temperatures using straight, dumbbell and cut-ring specimens. The test applies to all kinds of plastics: The absorption is calculated as a percentage of weight gain. ASTM D An American Society for Testing of Materials ASTM standard method for determining tensile strength, elongation and modulus of elasticity of reinforced or unreinforced plastics in the form of sheet, plate, moldings, rigid tubes and rods. Five I-V types, depending on dimensions, of dumbbell-shaped specimens with thickness not exceeding 14 mm are specified. Specified speed of testing varies depending on the specimen type and plastic rigidity. Tensile properties determined include tensile stress strength at yield and at break, percentage elongation at yield or at break and modulus of elasticity. See also tensile strength. The test is carried out under conditions excluding any significant creep or elastic strain rate and effects of moisture, curing, loss of plasticizer, etc. The specimen is placed at the bottom of the outer dilatometer tube and the tube is immersed in a liquid bath at a desired temperature. The bursting strength is determined as the hydrostatic pressure in pascals required to produce rupture when applied at a controlled rate through a rubber diaphragm to a circular area ASTM D An American Society for Testing of Materials ASTM standard test method for determining the tensile strength and percentage elongation at break and at yield, elastic modulus, tensile energy to break and other tensile properties of thin plastic film and sheeting of less than 1. Method A employs a constant rate of specimen grip separation, whereas Method B employs a constant rate of motion of one grip and a variable rate of motion of another, which is attached to a pendulum weighing head. The test is performed at very low rates of loading, e. The specimen geometry in this test produces a stress concentration in a small area of the specimen. The maximum stress, usually found near the onset of tearing, is recorded in newtons or poundsforce. Painted testing panels boards or plywood are exposed for several years on vertical fences facing both north and south and visually examined for failures at prescribed intervals months. ASTM D An American Society for Testing of Materials ASTM standard test method for determining gas transmission rate, permeance and permeability for homogeneous materials of plastic film, sheeting, laminates and plastic-coated papers or fabrics under steady-state conditions. The sample is mounted in a gas transmission cell to form a barrier between 2 chambers. One chamber contains the test gas at a high pressure, and the other chamber receives gas at a lower pressure. The transmission rate is monitored either by the increase in pressure in the receiving chamber Method M or by a change in volume of gas Method V. Tensile properties include yield strength, tensile strength, tensile strength at break, elongation at break, etc. The energy is calculated as the product of dart weight and dropping height. There are 2 test methods A and B using darts with different diameters of their hemispherical head and different dropping heights. ASTM D An American Society for Testing of Materials ASTM standard test method for determining coefficients of starting and sliding friction static and kinetic coefficients, respectively of plastic film and sheeting when sliding over itself or other substances under specified conditions. The resistance is measured as the average force, in grams, required to propagate tearing

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from a precut slit through a specified length, using an Elmendorf-type pendulum tester and 2 specimens, a rectangular type and one with a constant radius testing length. The calibrated apparatus is used to determine the volume of an excavated soil by measuring the drop in the level of the liquid that fills the apparatus and the void through expansion of the rubber balloon when the external pressure is applied. The tester has an oscillating folding head with a clamping jaw and a clamping jaw that can move in a direction perpendicular to the axis of rotation of the folding head. ASTM D An American Society for Testing of Materials ASTM standard method for determining the hardness of materials ranging from soft rubbers to some rigid plastics by measuring the penetration of a blunt type A or sharp type D indenter of a durometer at a specified force. The blunt indenter is used for softer materials and the sharp indenter - for more rigid materials. The transmittance is measured as the ratio of the radian flux transmitted by a specimen to that incident on it, in essentially the same direction. The test results are greatly influenced by the design characteristics of the instrument, e. The specification covers classification, inspection, certification, dimensions, weight, appearance, light transmission, weatherability, expansion, impact resistance, flammability and load-deflection properties of panels and their methods of testing. ASTM D An American Society for Testing of Materials ASTM standard test method for determining the steady-state transmission rate of oxygen gas through a plastic film, sheeting, laminates, coextrusions, or plastic-coated paper or fabric. ASTM D An American Society for Testing of Materials ASTM standard method for determination of butylated hydroxytoluene in ethylene polymers and ethylene-vinyl acetate copolymers by solvent extraction followed by gas chromatographic analysis. Detection of butylated hydroxytoluene is achieved by flame ionization. Butylated hydroxytoluene is a stabilizer used in the manufacture of the ethylene polymers. The material may be unreinforced or reinforced and may contain fibers or fabrics.

### Chapter 3 : Permeability Properties of plastics and elastomers

*Plastics Design Library is pleased to introduce Permeability And Other Film Properties Of Plastics And Elastomers, a unique reference and data bank on the barrier and film properties of polymeric materials.*

### Chapter 4 : Permeability Properties of Plastics and Elastomers - Laurence W. McKeen - Google Books

*Permeability and Other Film Properties of Plastics and Elastomers Details This handbook is a unique database reference on the barrier and film properties of plastics and elastomers to detailed discussions and test results.*

### Chapter 5 : Permeability and Other Film Properties of Plastics and Elastomers - Knovel

*Publisher Summary. This chapter reviews major production methods of films, membranes, and containers. The engineering of equipment for all these processes can be complex, and the small changes in plastic polymer properties can have large effects on production.*

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*Permeability and other film properties of plastics and elastomers.. [Plastics Design Library.]; -- This handbook is a database reference ranging in coverage from the barrier and film properties of plastics and elastomers to detailed discussions and test results.*

### Chapter 7 : Permeability of Polymers

*This data handbook is on the barrier and film properties of polymeric materials in thin sections. Data ranges from a*

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*general overview of the barrier properties of plastics and elastomers to.*