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Plastisols **General Information**

A PLASTISOL IS A GENERIC INDUSTRY TERM WHICH REFERS TO A FLUID DISPERSION OF A PVC (POLYVINYL CHLORIDE) RESIN. THEY HAVE BECOME A FAMILIAR MATERIAL TO THOUSANDS OF MANUFACTURERS MAKING SUCH PRODUCTS AS OVERSHOES, UPHOLSTERY FABRICS, TABLE CLOTHS, SHOWER CURTAINS, FOAM CUSHIONING, COATED PLATING RACKS, SMALL SOFT BODY FISHING LURES, SUPPORTED AND UNSUPPORTED GLOVES, AND TEXTILE SCREEN PRINTING INKS. THE ORIGINAL PATENT RELATING TO PLASTISOLS WAS ISSUED TO B F GOODRICH CHEMICAL COMPANY IN THE EARLY 1940'S WITH PATENT 2,188,396. IN 1947, GOODRICH INTRODUCED, COMMERCIALY, THE FIRST VINYL RESIN DESIGNED FOR MAKING PLASTISOLS.

MOLDED PLASTISOL VINYL IS NOT DISTINGUISHABLE FROM A CALENDARED VINYL OR AN INJECTION MOLDED VINYL OF THE SAME OR SIMILAR COMPOSITION OR QUALITY. PLASTISOLS, HOWEVER, OFFER A VERSATILITY OF PROPERTIES NOT FOUND IN OTHER VINYL MATERIALS. THEY ARE CUSTOM COMPOUNDED TO FIT SPECIFIC PROCESSING METHODS AND END USE APPLICATIONS.

PHYSICAL DESCRIPTION: PLASTISOLS ARE PHYSICAL MIXTURES OF VINYL RESINS AND COMPATIBLE PLASTICIZERS. IN ADDITION, THEY USUALLY CONTAIN HEAT STABILIZERS AND PIGMENTS. THE RAW MATERIALS ARE COMPOUNDED INTO FLUID PASTES (PLASTISOLS), WHICH CAN THEN BE USED FOR MOLDING, DIPPING, COATING AND CASTING. PLASTISOLS ARE 100% SOLIDS. THEY DO NOT REQUIRE THE EVAPORATION OF SOLVENTS OR WATER LIKE MOST FLUID COATINGS DO. ENHANCED PHYSICAL AND PROCESSING PROPERTIES ARE DERIVED BY MIXING OF THE PROPER KIND OF PLASTICIZER WITH THE PROPER TYPE OF RESIN. SUCH KNOWLEDGE COMES PRIMARILY WITH FORMULATION EXPERIENCE.

FUSION: CURE OF PLASTISOLS IS A PHYSICAL CHANGE OF THE RESIN BEING SOLVATED BY THE PLASTICIZER ON HEATING, MUCH THE SAME AS A GELATIN DESSERT, WHICH CONTAINS SUGAR, GELATIN, FLAVORANTS, COLOR, ODORANTS, ETC., IS "CURED" BY HEATING WITH WATER AND COOLING.

FUSION - PAGE 2 CONTINUED

CURING TAKES PLACE BY HEATING THE PLASTISOL TO BETWEEN 275° F AND 350° F. THE EXACT TEMPERATURE FOR FUSION VARIES FOR DIFFERENT FORMULATIONS. USUALLY, FUSION IS ACCOMPLISHED AT A TEMPERATURE 25° F TO 100° F HIGHER THAN THE PLASTISOL CURE TEMPERATURE TO SPEED HEAT TRANSFER. THE ITEM IS COOLED TO ROOM TEMPERATURE; WATER MAY BE USED TO COOL IF DESIRED.

THE CURED HOMOGENOUS SOLID PLASTIC MATERIAL HAS THE SAME EXCELLENT PHYSICAL PROPERTIES COMMONLY ASSOCIATED WITH OTHER VINYLs. THESE ARE FLEXIBILITY, TOUGHNESS, ABRASION AND CHEMICAL RESISTANCE, UNLIMITED COLOR POSSIBILITIES, OR HIGH CLARITY, AND EXCELLENT RESISTANCE TO AGING. PLASTISOLS ARE AVAILABLE IN FORMULATIONS OF ALL HARDNESS, RANGING FROM THE SOFTNESS OF A SOFT BODY FISHING WORM TO THE HARDNESS OF ALUMINUM. MANY DIFFERENT PROPERTIES CAN BE INCORPORATED AS WITH OTHER VINYLs, SUCH AS GOOD LOW TEMPERATURE FLEXIBILITY, RESISTANCE TO MARRING OF LACQUERS AND VARNISHED SURFACES, AND INFLAMMABILITY FOR USE AS A GOOD ELECTRICAL WIRING INSULATION. PLASTISOLS CAN ALSO BE COMPOUNDED WITH COMPONENTS THAT ARE PRE-APPROVED BY THE FDA UNDER VARIOUS FDA SECTIONS.

MOLDING PROCESSES

ROTOCASTING: A METAL CAVITY MAY BE COMPLETELY CLOSED AND THE ITEMS "ROTOCAST", OR THEY MAY BE IN OPEN MOLDS AND BE "SLUSH" MOLDED. IN THE ROTOCAST PROCESS, THE MOLD IS LOADED WITH THE DESIRED AMOUNT OF PLASTISOL AND THEN SEALED. THE MOLD IS THEN ROTATED ON TWO PLANES SIMULTANEOUSLY WHILE BEING HEATED. AFTER A PREDETERMINED TIME AT A GIVEN TEMPERATURE, THE MOLD IS COOLED WHILE STILL BEING ROTATED. WHEN COOL, THE PART IS REMOVED. CLOSED ITEMS SUCH AS BEACH BALLS, BASKETBALLS, ETC., ARE ROTOCASTED.

SLUSH MOLDING: IN THE "SLUSH" MOLD PROCESS THE TOP OF THE MOLD IS OPEN. THE MOLD IS FILLED WITH PLASTISOL AND THEN HEATED FOR A PREDETERMINED TIME AND TEMPERATURE, EITHER IN AN AIR OVEN OR A LIQUID BATH TO "GEL" A FILM OR LAYER OF PLASTISOL INSIDE THE MOLD SURFACE. AT A DETERMINED GEL THICKNESS, THE EXCESS PLASTISOL IS EMPTIED AND THE MOLD IS FURTHER HEATED TO CURE PLASTISOL IN THE MOLD. THE PLASTISOL WHICH WAS EMPTIED FROM THE MOLD MAY BE RE-USED. EXAMPLES OF SLUSH MOLDED ITEMS ARE VINYL DOLL PARTS AND SEAMLESS VINYL BOOTS."

MOLDING PROCESSES - PAGE 3 CONTINUED

DIP MOLDING / DIP COATING: DIP MOLDING IS SIMILAR TO SLUSH MOLDING BUT IN REVERSE. THE DIFFERENCE HERE IS THAT THE METAL MOLD IS FIRST HEATED, THEN INSERTED INTO A TANK OF ROOM TEMPERATURE PLASTISOL. THIS GELS A COATING ON THE MOLD SURFACE. THE MOLD WITH GEL COAT IS WITHDRAWN FROM THE PLASTISOL AND FURTHER HEATED TO CURE THE PLASTISOL COATING. THE CURED PLASTISOL PART IS COOLED AND STRIPPED OFF THE MOLD. ITEMS PRODUCED THIS WAY ARE: GRIPS, HANDLES, COVERS, COIN PURSES, CHAIN SAW GUARDS, ETC.

WHEN THE MOLDED VINYL IS NOT STRIPPED OFF, WE REFER TO THE PROCESS AS "HOT DIPPING" OR "DIP COATING". MANY ITEMS ARE COATED THIS WAY, WITH TOOL HANDLES BEING THE MOST WELL KNOWN. AN ADHESIVE PRIMER MAY BE USED BEFORE DIPPING INTO THE PLASTISOL TO BOND THE PLASTISOLS FIRMLY TO THE SUBSTRATE. A BONDED PLASTISOL COATING HAS MANY TIMES THE DURABILITY OF AN UNPRIMED COATING.

ROLLER COATING: ROLLER COATING IS USED TO APPLY PLASTISOL AND ORGANISOL (PLASTISOLS THINNED WITH SOLVENTS) COATINGS TO STEEL, CLOTH, ALUMINUM, PAPER OR VIRTUALLY ANY FLAT MATERIAL. A UNIFORM COATING THICKNESS FROM 2-50 MILS OR MORE MAY BE OBTAINED. THIS COATING METHOD IS APPLICABLE WHERE A PERMANENT OR STRIPPABLE COATING IS DESIRED.

THE ROLL COATING PROCESS INVOLVES A MOVING FLAT SUBSTRATE OR SUPPORTING WEB UPON WHICH THE SUBSTRATE TO BE COATED IS LAID. AS THE SUBSTRATE MOVES PLASTISOL MATERIAL IS DEPOSITED EITHER BY A MOVING ROLL (FOR THICK PLASTISOLS) OR A V-SHAPED POT OR TROUGH (FOR THIN COATINGS) DIRECTLY OVER THE WEB. OFTEN TIMES A KNIFE, SKIMMING BLADE OR BAR PRECEDES THE DEPOSIT POINT TO SKIM OFF EXCESS CURING OVENS WHERE THE PRODUCT IS CURED AND THEN COOLED. THE SUBSTRATE IS SPOOLED OR REMOVED FROM THE WEB AFTER COOLING. EXAMPLES OF MATERIALS ROLL COATED FOR A PROTECTIVE COATING DURING SHIPPING ARE CHROME PLATED STEEL BUILDING PANELS, AND POLISHED STAINLESS STEEL SHEETS. PLASTISOLS ARE ROLL COATED AND BONDED TO STEEL PANELS LOES ENTERPRISES, INC

ALSO, FOR THE PERMANENT PROTECTIVE AND DECORATIVE FINISH THEY PROVIDE. VINYL IS ALSO USED FOR ADHESIVE VINYL LETTERING CUT ON COMPUTERIZED PLOTTERS, AND LAYERED FOR FLOORING AND MATTING APPLICATIONS.

SPRAY COATINGS: A PLASTISOL MAY BE SPRAYED IF THE VISCOSITY (FLUIDITY) IS LOWERED WHEN UNDER SHEAR. TO DO THIS, VARIOUS VOLATILE PLASTICIZERS OR SOLVENTS MAY BE USED, WHICH VOLATILIZE DURING SPRAYING AND CURING. THICKENERS MAY BE ADDED TO GIVE A HIGH LOW SHEAR VISCOSITY, WHICH GIVES THE PLASTISOL A MAYONNAISE LIKE CONSISTENCY THAT WILL NOT SAG OR RUN AFTER APPLICATION. PLASTISOLS CONTAINING SOLVENTS ARE COMMONLY REFERRED TO AS ORGANISOLS. SIMILARLY FORMULATED ORGANISOLS ARE USED

MOLDING PROCESSES - PAGE 4 CONTINUED

TO COAT IRREGULAR ITEMS SUCH AS WIRE PARTS BY DIPPING THE ITEM COLD AND CURING THE DIPPED PART IN AN OVEN.

COATINGS UP TO 60 MILS THICKNESS MAY BE SPRAY COATED ONTO HORIZONTAL OR VERTICAL SURFACES. SPRAYING PERMITS COATING OF LARGE OR IRREGULAR SHAPED OBJECTS WHERE DIPPING IS NOT PRACTICAL. THE PLASTISOL OR ORGANISOL MAY BE APPLIED TO ALMOST ANY OBJECT BY AIRLESS, AIR OR ELECTROSTATIC SPRAY COATING AFTER THE PART IS FABRICATED. SPRAY COATINGS MAY BE APPLIED AS A SMOOTH OR TEXTURED SURFACE. SPECIAL TECHNIQUES ARE USED TO ACHIEVE TEXTURED EFFECTS SUCH AS WRINKLE FINISH OR ALLIGATORING.

OPEN AND CLOSED CAVITY MOLDING: THIS PROCESS REFERS TO MOLDING VINYL IN A SINGLE OR MULTIPIECE MOLD. THE PLASTISOL IS PUMPED OR Poured INTO THE OPEN OR CLOSED CAVITY AND CURED. OPEN CAST PRODUCTS MADE WITH THESE PROCESSES ARE MEDIA GASKETING FOR FILTRATION PRODUCTS, FATIGUE MATS, AND NOVELTY SPLASH GUARDS OR MUDFLAPS. CLOSED CAST PRODUCTS INCLUDE ELECTRONIC SWITCH MATS AND NOVELTY TORY ITEMS.

SOFT BODY FISHING LURES ARE ALSO CLOSED CAST OR INJECTION MOLDED. THE DISTINCTION HERE IS THAT THIS PLASTISOL MATERIAL BEING OF LOW HARDNESS OR DUROMETER CAN ACTUALLY BE INJECTED IN ITS CURED STATE. THE LOW HARDNESS OF THIS MATERIAL IS WHAT PERMITS THE MATERIAL TO HAVE HOT FLOW OR A HOT MELT VISCOSITY WHEN CURED.

SCREEN PRINTING: THE PROCESS OF SILK SCREEN PRINTING IS USUALLY ASSOCIATED WITH IMPRINTED SPORTSWEAR RETAIL ITEMS. HOWEVER, THERE ARE OTHER PRODUCTS WHICH ARE SUITED TO THIS METHOD OF MANUFACTURE. ANY FLAT OBJECT ON WHICH YOU WISH TO DEPOSIT A COATING LAYER THAT RANGES IN THICKNESS FROM 5 TO 50 MILS CAN BE SCREEN PRINTED.

GENERAL PROPERTIES OF PLASTISOLS AND ORGANISOL COATINGS

PHYSICAL PROPERTIES:

MASS SOLID DENSITY (LB/GALLON):	7.9-20.0 #/GAL OR 59-150 #/FT ³
CELLULAR DENSITY:	CHEMICAL FOAM TO 8#/FT ³ MECHANICAL FOAM TO 4#/FT ³
SURFACE FINISHES:	HIGH TO LOW GLOSS (FLAT); MATTE OR TEXTURED
FLAMMABILITY:	GENERALLY WILL NOT SUPPORT COMBUSTION (MAY BE FORMULATED TO BE SELF EXTINGUISHING) UL94HB, FMVSS 302

GENERAL PROPERTIES - PAGE 5 CONTINUED

THERMAL CONDUCTIVITY: BTU/(SQ FT)(HOUR)(TEMP)	0.07 - 0.1
WATER ABSORPTION (IN 24 HRS):	0.01 - 1.2
CURED FILM DENSITY (LB/(SQ FT)(MIL):	0.005 - 0.0125
COLORS:	COMPLETE RANGE - UNLIMITED INCLUDING HIGH CLARITY & TINTS
WEATHERABILITY - U V:	GOOD - EXCELLENT/UP TO 25 YEARS
DEMOLDABLE & SELF ADHERING:	
MOISTURE VAPOR TRANSMISSION: (GM/100 SQ IN/MIL 24 HRS @ 95°F) (100% RELATIVE HUMIDITY)	10

MECHANICAL & ELECTRICAL PROPERTIES:

TENSILE STRENGTH (PSI)	200 - 5,000
ELONGATION (%)	100 - 600
SHORE/HARDNESS	S00 10-SD 80
COLD TEMPERATURE FLEXIBILITY	TO -75° F
DI-ELECTRIC STRENGTH (VOLTS/MIL)	300 - 500
SPECIFIC RESISTANCE (OHM/CM)	1010 - 1015
CHEMICAL RESISTANCE	VARIES W/TEMPERATURE GOOD POOR
MORE SPECIFIC RECOMMENDATIONS CAN BE MADE ON SPECIFIC REAGENTS. CHEMICAL RESISTANCE AND/OR MATERIAL COMPATIBILITY CAN BE ENHANCED BY CUSTOM COMPOUNDING.	MINERAL ACIDS, SOLVENTS ORGANIC BASES, ALCOHOLS, ALDEHYDES, PETROLEUM SOLVENTS, OILS