DuPont Powder Coatings

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

Product Information

Chemical resistance guide

Abcite®,

A DuPont powder coating resin

Chemical resistance of Abcite® grades

Abcite® grades have outstanding resistance to both physical and chemical attack. They are also highly resistant to permeation by liquids.

Note : Tests were carried out on coating thicknesses of 500 µ.

Chemical environmental effects on *Abcite*® grades may be divided into three categories: oxidation, stress cracking and plasticization. Only oxidation is a chemical degradation, the other two involve the physical properties of the polymer.

Oxidizers

The chemical effects on *Abcite*® grades of even a strong oxidizer may be gradual and may not be measurable over the short term. However, they may be significant over the long term and should be evaluated if continuous exposure is expected. The following materials are examples of strong oxidizers which are unsuitable for long term exposure to Abcite:

Nitric acid, fuming
Sulfuric acid, fuming (oleum)
Aqua regia
Chlorine (wet gas)
Bromine (liquid)

Stress cracking agents

Certain surface-active materials, although they have no chemical effect on *Abcite*® grades, can accelerate cracking when under stress. This accelerated form of stress failure is called environmental stress cracking (ESC). ESC failure depends on the amount of stress in the *Abcite*® grades and, therefore, thermal history and design factors are very important. The following materials are examples of stress crack agents which are unsuitable for long term exposure to *Abcite*® grades:

Methyl Alcohol
Ethyl Alcohol
n-Propyl Alcohol
Isopropyl Alcohol
Ethylene Glycol

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Plasticizers

Certain types of non-acqueous chemicals are absorbed to varying degrees by *Abcite*® grades causing swelling, weight gain, softening and some loss of yield strength. These plasticizing materials cause no actual chemical degradation of the resin. Some organic solvents such as aliphatic hydrocarbons, chlorinated hydrocarbons, aromatics and heterocyclic compounds have a strong plasticizing action (10-20 % solubility in the polymer). However, most of these solvents are sufficiently volatile so that if they are removed from contact with *Abcite*® grades, the part will ñdry outò and return to its original condition with no impairment of properties.

Testing is important

It cannot be expected that one chemical resistance data chart will include the effects of all chemicals on *Abcite*® grades. Furthermore, the suitability of *Abcite*® grades depend not only on the nature of the chemical environment but also on the expected service temperature and stress, the duration of exposure and whether it is intermitted or continuous. Because so many variables are involved, it must be recognized that standard laboratory tests can give only a general guide as to whether *Abcite*® grades may resist exposure to a specific environment. *Therefore, the feasibility of any chemical environment must be determined by extensive laboratory tests carried out under conditions which approximate as closely as possible those expected in service.*

1. Immerse a sample of choosen *Abcite*® in the chemical under study. The choosen *Abcite*® sample should be preweighed and immersed at the expected service temperature for a reasonable time (Note: many of the chemicals under study may be toxic, corrosive, flammable, and/or irritants. In addition, many of the chemicals under study should not be inhaled, ingested or in contact with the human skin. Therefore, accepted industrial standards should be used when involved with these chemicals).

2. At the end of the test period the *Abcite*® sample should be reweighed to determine if there is a weight gain or loss. In addition, any change in surface hardness should be noted.

3. Check for chemical degradation of the *Abcite*® sample by observing any surface crazing, cracking or discoloration.

4. Tensile properties should be checked by measuring ultimate tensile strength and elongation. Tensile properties will change with percent plasticization. If chemical attack has occurred, a remarkable decrease in ultimate tensile strength should be evident.

5. Environmental stress cracking characteristics of the chemical under study can be determined using ASTM test procedure D 1693 by substituting the chemical of interest for the test liquid specified in this procedure.

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Guide to chemical resistance

The chemical resistance data presented in the following table originated in part from tests conducted at DuPont Laboratories and, in part, from reliable published sources. These datas are valid for *Abcite*® X45, X0545, X60, X1060, X70 and X2070. It is some minors differences in their chemical resistances as they are all based on modified ethylen/methacrylic acid copolymer.

This table is intended only as a preliminary, general guide to the resistance for Abcite® *grades to various chemicals. It should not be used by the industry as the basis for final decisions because the specific end use application, design and/or conditions of use may have added effects on performance in particular chemical environment. It is recommended that laboratory testing of the specific end use application be conducted under expected service conditions.*

General guide to resistance of *Abcite*® grades to various chemicals

Resistance code		Caution code	
R	Resistant, no indication that Serviceability would be impaired	O	Oxidizer
V	Variable resistance, depending on conditions of use*	P	Plasticizer
U	Not resistant. Not recommended for service applications under any conditions	A	Known stress crack agent**
		B	Possible stress crack agent**

* The classification ñvariable resistanceò is very broad. Depending on the nature of the chemical, its concentration, the service temperature and pressure, and the time of exposure, *Abcite*® grades can be either very resistant or very susceptible to attack. Therefore, where *Abcite*® grades are said to have variable resistance to a chemical, it is critical that extensive pretesting be conducted.

** A system using *Abcite*® grades in exposure to a chemical to which it is designated resistant, but which carries a stress identifier (A or B), may be serviceable over a useful lifetime providing the following precautions are observed:

a.Stresses in the fabricated *Abcite*® grades must be minimized by design and processing.

b.Conditions and limitations of the application should be carefully observed (avoidance of high temperature, etc.)

Edition of May 2000, subject to modifications (MM)

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Chemical resistance data - Abcite® grades

Caution code	Chemical	Chemical resistance code	
		21° C (70° F)	60° C (140° F)
B	Acetaldehyde(100%O)	V	U
	Acetic Acid (10%)	R	R
B	Acetic Acid (60%)	R	V
	Acetic Anhydride	R	R
	Acetone	R	*
	Acrylic Emulsions	R	R
	Adipic Acid	R	R
	Air	R	R
B, P	Allyl Chloride	U	U
	Aluminum Chloride	R	R
	Aluminum Fluoride	R	R
	Aluminum Hydroxide	R	R
	Aluminum Nitrate	R	R
	Aluminum Oxychloride	R	R
	Aluminum Sulfate	R	R
	Alums (all types)	R	R
	Ammonia (100% dry gas)	R	R
	Ammonia, Liquid	R	R
	Ammonium Acetate	R	R
	Ammonium Carbonate	R	R
	Ammonium Chloride	R	R
	Ammonium Fluoride	R	R
	Ammonium Hydroxide(10-28%)	R	R
	AmmoniUm Metaphosphate	R	R
	Ammonium Nitrate	R	R
	Ammonium Persulfate	R	R
	Ammonium Phosphate, Ammoniacal and Neutral	R	R
	Ammonium Sulfide	R	R
	Ammonium Sulfate	R	R
	Ammonium Thiocynate	R	R
B, P	Amyl Acetate (100%)	U	U
A, P	Amyl Alcohol (100%)	V	V
P	Amyl Chloride(100%)	U	U
P	Aniline (100%O)	R	U
P	Aniline Hydrochloride	U	U
	Anthraquinone	R	R
	Anthraquinone Sulfonic Acid	R	R
	Antimony Trichloride	R	R
O	Aqua Regia	U	U
P	Aromatic Hydrocarbons	R	V
	Arsenic Acid	R	R
	Ascorbic Acid(10%)	R	R
	Barium Carbonate	R	R
	Barium Chloride	R	R
	Barium Hydroxide	R	R
	Barium Sulfate	R	R
	Barium Sulfide	R	R
	Beer	R	R
B	Beet Sugar Liquors	R	R
B	Benzaldehyde	V	U
P	Benzene	R	V
P	Benzene Sulfonic Acid	R	R

Caution code	Chemical	Chemical resistance code	
		21° C (70° F)	60° C (140° F)
	Benzoic Acid	R	R
	Bismuth Carbonate	R	R
	Black Liquor	R	R
	Bleach Lye (10%)	R	R
	Borax	R	R
	Boric Acid	R	R
	Brine	R	R
	Bromic Acid	R	V
O	Bromine, Liquid	U	U
O	Bromine, Vapor (25%)	U	U
O	Bromine, Water	U	U
P	Butadiene	V	*
P	Butane	R	*
A	Butanediol	R	V
	Butter	R	R
P	n-Butyl Acetate(100%)	R	V
A	n-Butyl Alcohol (100%)	V	U
	Butyric Acid	U	U
	Cadmium Cyanide	R	R
	Calcium Bisulfite	R	R
	Calcium Bilsulfide	R	R
	Calcium Carbonate	R	R
	Calcium Chlorate	R	R
	Calcium Chloride	R	R
	Calcium Hydroxide	R	R
B	Calcium Hydroxide (bleach solut.)	V	V
	Calcium Nitrate (50%)	R	R
	Calcium Oxide	R	R
	Calcium Sultate	R	R
B, P	Camphor Oil	U	U
	Carbon (slurry)	R	R
	Carbon Dioxide	R	R
	Carbon Disulfide	U	U
	Carbon Monoxide	R	R
P	Carbon Tetrachloride	U	U
	Carbonic Acid	R	R
	Castor Oil	R	R
	Caustic Potash	R	R
	Caustic Soda	R	R
P	Cellosolve	R	U
P	Chloralhydrate	U	U
O	Chlorine (100% dry gas)	U	U
O	Chlorine (wet gas)	U	U
O	Chlorine Liquid	U	U
B	ChlorineWater (2%)	R	V
P	Chlorobenzene	U	U
P	Chloroform	U	U
	Chlorosulfonic Acid(100%)	U	U
	Chromic Acid (10%)	R	*
O	Chromic Acid (30-50%)	R	*
	Cider	R	R
	Citric Acid	R	R
A	Coconut Oil Alcohols	R	V
	Coffee	R	R

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Chemical resistance data - Abcite® grades

Caution code	Chemical	Chemical resistance code 21° C (70° F)	60° C (140° F)
	Cola Concentrates	R	R
	Copper Carbonate	R	R
	Copper Chloride	R	R
	Copper Cyanide	R	R
	Copper Fluoride(2%)	R	R
	Copper Nitrate	R	R
	Copper Sulfate	R	R
	Corn Oil	R	R
	Corn Syrup	R	R
P	Cottonseed Oil	R	R
P	Cresol	U	U
	Crude Oil	R	R
	Cupric Fluoride	R	R
	Cugric Sulfate	R	R
	Cuprous Chloride	R	R
B	Cyclohexanol	R	V
P	Cyclohexanone	R	U
B	Detergents, Synthetic	R	R
	Developers, Photographic	R	R
	Dextrin	R	R
	Dextrose	R	R
	Diazo Salts	R	R
	Dibutylphthalate	R	V
B, P	Dichlorobenzene (o & p)	U	U
B	Diethyl Ketone	V	U
A	Diethylene Glycol	R	V
A	Diglycolic Acid	R	R
	Dimethylamine	U	U
P	Dioclylphthalate	R	U
	Disodium Phosphate	R	R
	Distilled Water	R	R
P	Esters	R	V
P	Ethers	R	V
P	Ethyl Acetate(100%)	R	U
P	Ethyl Acrylate	R	V
A	Ethyl Alcohol	V	U
B,P	Ethyl Benzene	U	U
P	Ethyl Chloride	U	U
P	Ethyl Ether	U	U
B, P	Ethylene Bromide	U	U
B, P	Ethylene Chloride	U	U
B, P	Ethylene Chlorohydrin	U	U
B, P	Ethylene Dichloride	U	U
A	Ethylene Glycol	U	U
	Ethylene Oxide	R	V
	Ferric Chloride	R	R
	Ferric Hydroxide	R	R
	Ferric Nitrate	R	R
	Ferric Sulfate	R	R
	Ferrous Chloride	R	R
	Ferrous Sulfate	R	R
	Fish Solubles	R	R
	Fluoboric Acid	R	R
O	Fluorine, Gas, Wet	U	U
	Fluosilicic Acid (conc.)	R	V

Caution code	Chemical	Chemical resistance code 21° C (70° C)	60° C (140° F)
	Fluosilicic Acid (32%)	R	R
B	Formaldehyde	R	V
	Formic Acid	R	R
	Fructose	R	R
B	Fruit Pulp	R	R
P	FurFural (100%)	U	U
B, P	Furfuryl Alcohol	U	U
B	Gallic Acid	R	R
P	Gas, Natural, Dry and Wet	R	*
P	Gasoline	R	V
P	Gasoline, High Octane	R	V
P	Genetron 11, 12 & 22	r	*
	Glucose	R	R
B	Glycerine	R	R
A	Glycol	V	U
A	Glycolic Acid (30%)	R	R
	GrapeSugar (sat.aq.)	R	R
P	n-Heptane	R	V
	Hexachlorobenzene	R	R
P	Hexane	R	V
B	Hexanol, Tertiary	R	R
*	Hydrobromic Acid (50%)	R	R
	Hydrochloric Acid	R	R
	Hydrocyanic Acid	R	R
*	Hydrofluoric Acid(40-60%)	R	R
	Hydrogen (100%)	R	R
	Hydrogen Chloride (dry gas)	R	R
	Hydrogen Peroxide (3%)	R	V
	Hydrogen Sulfide	R	R
	Hydroquinone	R	R
	Hydroxylamine Sulfate	R	R
	Hypochlorous Acid	R	R
B	Inks	R	R
O	Iodine (in KI solution)	U	U
A	Isopropyl Alcohol	V	U
P	Jet Fuels JP4 and JP5	V	U
P	Kerosene	V	U
	Kraft Liquors	R	R
	Lactic Acid (25%)	R	R
	Lard Oil	R	R
	Latex	R	R
	Lauric Acid	R	V
P	Lauryl Chloride	V	*
	Lead Acetate	R	R
	Lead Chloride	R	R
	Lead Nitrate	R	R
	Lead Sulfate	R	R
P	Linseed Oil	V	U
	Lithium Bromide	R	R
	Lubricating Oil ASTM No 1, No. 2, No. 3	R	V

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Chemical resistance data - Abcite® grades

Caution code	Chemical	Chemical resistance code 21° C (70° F)	60° C (140° F)
P	Machine Oil	R	V
	Magnesium Carbonate	R	R
	Magnesium Chloride	R	R
	Magnesium Citrate	R	R
	Magnesium Hydroxide	R	R
	Magnesium Nitrate	R	R
	Magnesium Sulfate	R	R
	Maleic Acid	R	R
	Mercuric Chloride	R	R
	Mercuric Cyanide	R	R
	Mercurous Nitrate	R	R
	Mercury	R	R
P	Methane	R	*
A	Methyl Alcohol	V	U
P	Methyl Chloride	U	U
P	Methyl Ethyl Ketone	R	V
P	Methyl Isobutyl Ketone	R	V
	Methyl Sulfate	R	R
	Methyl Sulfuric Acid	R	R
B,P	Methylene Chloride (100%)	U	U
	Milk	R	R
	Mineral Oils	R	R
	Molasses	R	R
P	Naphta	V	U
P	Naphtalane	U	U
	Nickel Chloride	R	R
	Nickel Nitrate	R	R
	Nickel Sulfate	R	R
B	Nicotine (dilute)	R	R
	Nitric Acid (0-10%)	R	V
O	Nitric Acid (10-98%)	U	U
O	Nitric Acid, fuming	U	U
P	Nitrobenzene(100%)	U	U
P	Nitrous Oxide	R	*
P	n-Octane	R	R
P	Oleic Acid	U	U
	Oxalic Acid	R	R
O	Oxygen	R	V
O	Ozone	R	*
O	Perchloric Acid (10-70%)	U	U
P	Perchloroethylene	R	U
P	Phenol	U	U
P	Phenylhydrazine	U	U
P	Phenylhydrazine Hydrochloride	U	U

Caution code	Chemical	Chemical resistance code 21° C (70° C)	60° C (140° F)
	Phosphoric Acid	R	R
	Photographic Solutions	R	R
O	Picric Acid	U	U
	Plating Solutions	R	R
	Brass	R	R
	Cadmium	R	R
	Copper	R	R
	Gold	R	R
	Lead	R	R
	Nickel	R	R
	Silver	R	R
	Tin	R	R
	Zinc	R	R
	Potassium Bicarbonate	R	R
	Potassium Bichromate	R	R
	Potassium Borate	R	R
	Potassium Bromate	R	R
	Potassium Carbonate	R	R
	Potassium Chlorate	R	R
	Potassium Chloride	R	R
	PotassiUm Chromate (40%)	R	R
	Potassium Cyanide	R	R
	Potassium Dichromate (40%)	R	R
	Potassium Ferri/Ferro Cyanide	R	R
	Potassium Fluoride	R	R
	Potassium Hydroxide	R	R
	Potassium Nitrate	R	R
	Potassium Perborate	R	R
	Potassium Perchlorate (10%)	R	R
	Potassium Permanganate (20%)	R	R
	Potassium Persulfate	R	R
	Potassium Sulfate	R	R
	Potassium Sulfide	R	R
	Potassium Sulfite	R	R
P	Propane	U	U
A	Propargyl Alcohol	R	V
A	n-Propyl Alcohol	V	U
P	Propylene Dichloride (100%)	U	U
A	Propylene Glycol	R	V
	Pyridine	R	U
	Resorcinol	R	R
	Salicylic Acid	R	R
	Sea Water	R	R
	Selenic Acid	R	R
	Sewage	R	R
	Shortening	R	R
	Silicic Acid	R	R
	Silver Cyanide	R	R
	Silver Nitrate Solution	R	R
	Silver Sulfate	R	R
	Soap Solution	R	R

DuPont Polymer Powders Switzerland SA
Rue St-Joseph 25 / P.O. Box 140
CH-1630 Bulle 1

DuPont Powder Coatings

Chemical resistance data - Abcite® grades

Caution code	Chemical	Chemical resistance code 21° C (70° F)	60° C (140° F)
	Sodium Acetate	R	R
	Sodium Benzoate (35%)	R	R
	Sodium Bicarbonate	R	R
	Sodium Bisulfate	R	R
	Sodium Bisulfite	R	R
	Sodium Borate	R	R
	Sodium Bromide (dilute)	R	R
	Sodium Carbonate	R	R
	Sodium Chlorate	R	R
	Sodium Chloride	R	R
	Sodium Cyanide	R	R
	Sodium Dichromate	R	R
	Sodium Ferri/Ferro Cyanide	R	R
	Sodium Fiuoride	R	R
	Sodium Hydroxide	R	R
	Sodium Hypochlorite	R	R
	Sodium Nitrate	R	R
	Sodium Nitrite	R	R
	Sodium Peroxide	R	*
	SodiumSulfate	R	R
	Sodium Suifide	R	R
	Sodium Sulfite	R	R
	Sour Crude Oil	R	V
	Stannic Chloride	R	R
	Stannous Chloride	R	R
	Starch Solution	R	R
	Stearic Acid (100%)	R	R
P	Stoddards Solvent	R	V
	Sulfur	R	R
	Sulfur Dioxide,Dry or Wet	R	V
	Sulfuric Acid (0-30%)	R	R
O	Sulfuric Acid (30-98%)	U	U
O	Sulfuric Acid, fuming (oleum)	U	U
	Sulfurous Acid	R	R
P	Tallow	R	V
	Tannic Acid	R	R
	Tanning Liquors	R	R
P	Tartaric Acid	R	R
	Tetrahydrofuran	U	U
P	Thionyl Chloride	U	U
	TtaniumTetrachloride	U	U
P	Toluene	U	U
P	Tributylphosphate	V	V
P	Trichloroethylene	U	U
B	Triethylene Glycol	R	V
	Trisodium Phosphate	R	R
P	Turpentine	V	U
	Urea (0-30%)	R	R
	Urine	R	R
A	Vanilla Extract	R	V
	Vinegar	R	R
	Vinyl Acetate	V	*
	Water	R	R
	Water, Acid Mine	R	R
	Water, Salt and Sea	R	R
	Wetting Agents	R	R
A	Whiskey	R	V
B	Wines	R	V
P	Xylene	R	V
	Yeast	R	R
	Zinc Bromide	R	R
	Zinc Carbonate	R	R
	Zinc Chloride	R	R
	Zinc Nitrate	R	R
	Zinc Oxide	R	R
	Zinc Stearate	R	R
	Zinc Sulfate	R	R

R	- Resistant
V	- Variable resistance
U	- Not resistant
*	- Insufficient data

Refer to text for explanation of Resistance and Caution Codes.

Fore further informations on *Abcite*® grades, please contact:

Martial Ducotterd
Technical Support Metal Coating
Tel:++41 26 913 53 09
Fax: ++41 26 912 79 89
e-mail: martial.ducotterd@dupontpowder.ch

Marcel Melis
Product Line Manager Metal Coating
Tel:++41 26 913 52 15
Fax: ++41 26 912 79 89
e-mail: marcel.melis@dupontpowder.ch

Edition of May 2000, subject to modifications (MM)