

Industrial Summit Technology Corporation
Material Safety Data Sheet

SKYBOND® 2595 POLYIMIDE RESIN

1. PRODUCT IDENTIFICATION

Synonym:	Solution of aromatic polyimide precursor in ethanol, xylene and n-methyl pyrrolidone (NMP)
Chemical Name:	1,2-Benzenedicarboxylic acid, 4,4'-carbonylbis-, ar, ar'-diethyl ester, compd. With 1,3-benzenediamine
CAS No.:	65701-07-7
TSCA Inventory:	All components of this product appear on the Inventory of Chemical Substances published by the U.S. Environmental Protection Agency (EPA) under the authority of the Toxic Substances Control Act (TSCA).
DOT Proper Shipping Name:	Resin Solution
DOT Hazard Class/I.D. No./Packaging Group:	3 Flammable Liquid / UN 1866 / PG II
DOT Label:	Flammable Liquid U.S.
Surface Freight Classification:	Plastics, synthetic, N.O.I. liquid
Reportable Quantity (RQ) Under Dot (49 CFR) and CERCLA Regulations:	Package of 6,250 lbs. or more contains 1,000 lb. RQ of xylene.
SARA Hazard Notification Hazard Categories under criteria of SARA Title III rules (40 CFR Part 370):	Immediate, Delayed, Fire.
Section 313 Toxic Chemical(s):	This product contains the following substances which are defined as toxic chemicals under, and subject to the reporting requirements of, Section 313 of Title III of the Superfund Amendments and Reauthorization
Act of 1986 and 40 CFR Part 372:	<ul style="list-style-type: none">• Xylene (dimethylbenzene), CAS No. 1330-20-7• 1,3-Diaminobenzene (m-phenylenediamine), CAS No. 108-45-2• N-Methylpyrrolidinone (n-methylpyrrolidone, NMP), CAS No. 872-50-4• Ethylbenzene, CAS No. 100-41-4

In addition to the SARA 313 chemicals listed above, this product contains the following substances which is identified as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Ethyl alcohol (ethanol), CAS No. 64-17-5

2. WARNING STATEMENTS

DANGER!
FLAMMABLE LIQUID AND VAPOR

HARMFUL IF INHALED CAUSES EYE, SKIN AND RESPIRATORY TRACT IRRITATION MAY CAUSE ALLERGIC SKIN REACTION CONTAINS m-PHENYLENDIAMINE WHICH MAY CAUSE LIVER DAMAGE BASED ON ANIMAL DATA

3. PRECAUTIONARY MEASURES

Keep away from heat, sparks and flame.
Use with adequate ventilation.
Do not get in eyes, on skin or on clothing.
Avoid breathing vapors.
Keep container closed.
Wash thoroughly after handling.

CONTAINER HAZARDOUS WHEN EMPTY:

Emptied containers resin vapor and product residue. FOLLOW LABELED WARNINGS EVEN AFTER CONTAINER IS EMPTIED. RESIDUAL VAPORS MAY EXPLODE ON IGNITION. DO NOT CUT, DRILL, GRIND OR WELD ON OR NEAR THIS CONTAINER. Improper disposal or reuse of this container may be dangerous and/or illegal.

4. EMERGENCY AND FIRST AID PROCEDURES

FIRST AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. Contact a poison control center. Remove material from eyes, skin and clothing.

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Get medical attention. Remove material from skin and clothing.

IF ON SKIN, Immediately wash with soap and plenty of water. Remove contaminated clothing. Get medical attention. Wash clothing before reuse.

IN CASE OF:

FIRE, use water spray, dry chemical, foam or carbon dioxide.

SPILL OR LEAK, flush area with water spray (see "Spill, Leak & Disposal Information" section).

5. OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Where there is significant potential for eye contact, wear chemical goggles and have eye flushing equipment available.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine type of glove for given application. Wear chemical safety goggles, a face shield and a chemical resistant apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

Attention! Repeated or prolonged contact may cause allergic skin reaction in some people.

Respiratory Protection: Avoid breathing vapor and/or mist. Use NIOSH/MSHA approved respiratory protection equipment (full facepiece recommended) when airborne exposure

limits (see below) are exceeded. If used, full facepiece type respirators need equipment for face shield and chemical goggles. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer. Respiratory protection programs must comply with 29 CFR 1910.134.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment. Consult NFPA Standard 91 for design of exhaust system.

Airborne Exposure Limits:

Product: SKYBOND® 2595 polyimide resin
OSHA PEL: None established
ACGIH TLV: None established

Component: Ethanol wt. % ~14
OSHA PEL/8-hour Time-weighted average: 1,000ppm
ACGIH TLV/8-hour Time-weighted average: 1,000ppm

Component: Xylene wt. % ~16
OSHA PEL/8-hour Time-weighted average: 100ppm Short-term Exposure Limit: 150ppm
ACGIH TLV/8-hour Time-weighted average: 100ppm Short-term Exposure Limit: 150ppm

Component: n-Methylpyrrolidone wt. % ~5
OSHA PEL: None established
ACGIH TLV: None established

IST Corp. has adopted, for its own internal use, an exposure limit 2ppm (8 mg/m³) (Skin)*, 8-hour time-weighted average for this material.

Component: Ethylbenzene (contained in xylene) wt. % ~3
OSHA PEL/8-hour Time-weighted average: 100ppm
Short-term Exposure Limit: 125ppm
ACGIH TLV/8-hour Time-weighted average: 100ppm
Short-term Exposure Limit: 125ppm

Component: m-Phenylenediamine wt. % ~13
OSHA PEL: None established
ACGIH TLV: None established

*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

6. FIRE PROTECTION INFORMATION

Flash Point: 45°F (estimated)

Extinguishing Media: Water spray, foam, dry chemical, carbon dioxide or any Class B extinguishing agent.

Special Firefighting Procedures: Firefighters and others who may be exposed to products of combustion (see "Hazardous Decomposition Products", below) should wear full protective clothing and self-contained breathing apparatus. Thoroughly decontaminate equipment after use.

Unusual Fire and Explosion Hazards: Closed containers exposed to heat may build up pressure. Use water spray to keep exposed containers and equipment cool.

7. REACTIVITY DATA

Materials To Avoid:	Strong oxidizing agent, strong alkali.
Conditions To Avoid:	Do not expose to heat or ignition sources. Volatiles given off during cure – ethanol, n-methylpyrrolidone, xylene.
Hazardous Decomposition Products:	Carbon monoxide, nitrogenous products.
Hazardous Polymerization:	Does not occur.

8. HEALTH EFFECTS SUMMARY

The following information summarizes human experience and the results of scientific investigations reviewed by health professionals for hazard evaluation of Skybond® 2595 polyimide resin solution and development of Precautionary Measures and Occupational Control Procedures recommended in this document.

Effects of Exposure

Inhalation and skin contact are expected to be the primary routes of occupational exposure to SKYBOND® 2595 polyimide resin. Occupational exposure to this material has not been reported to cause significant adverse human health effects. However, this material is considered to cause eye burns based on animal studies. The organic solvents described below have been reported to cause eye, skin and respiratory tract irritation and may contribute to the irritancy of this material. These solvents also possess narcotic-like properties; excessive exposure may result in headache, dizziness, incoordination, nausea, loss of appetite and loss of consciousness.

Meta-phenylenediamine (m-PDA) may be present in free or partially reacted form (salts) in this resin. It has been reported to cause eye, skin and respiratory tract irritation and may contribute to the irritancy of this material. It is considered to be moderately toxic orally and by inhalation. M-PDA is absorbed through the skin and may cause staining of the skin if contact occurs. Although infrequent in humans, allergic skin reaction has been reported following contact with m-PDA. This component may cause liver damage based on animal data. Limited reports in the scientific literature suggest possible liver changes occurring in humans occupationally exposed to low levels of m-PDA.

Toxicological Data

I.S.T Corp. has not conducted studies on SKYBOND 2595 polyimide resin and no data were obtained in a search of the available scientific literature. However, toxicity information is available on representative resins:

Single-dose (acute) animal studies conducted on representative polyimide resins indicate that these materials are slightly toxic practically nontoxic orally (rats) and practically nontoxic after skin application (rabbits). They range from practically nonirritating to moderately irritating to rabbit skin and moderately irritating to corrosive to rabbit eyes.

Skybond 2595 has not been tested for the potential to produce allergic skin reaction. However, no allergic skin reaction was observed in guinea pigs following repeated skin exposure to related SKYBOND polyimide resins.

Components

Data from I.S.T Corp. studies and from the available scientific literature on the components of SKYBOND 2595 polyimide resin which have been identified under the criteria of the OSHA Hazard Communication Standard (29 CHR 1910.1200) are discussed below:

Meta-phenylenediamine (m-PDA)

Meta-phenylenediamine (m-PDA) is used in the production of this polyimide resin. Single-dose (acute) animal studies indicate that m-PDA is moderately toxic orally (rats) and by inhalation (rats) and slightly toxic after skin

application (rabbits). It is moderately irritating to rabbit eyes and skin. Allergic skin reactions have been reported in various laboratory animals in repeated skin application tests. Rats given this material orally for 90 days showed increased liver and kidney weights and liver damage.

No significant increase in tumors was reported in drinking water study (mice, 78 weeks), skin painting study (mice, 24 months) or a long-term feeding study (rats, mice). No birth defects were reported in rats given this material orally during pregnancy, even at levels which produced toxic effects in the mothers. Adverse genetic effects have been reported in standard tests using bacterial and animal cells. Both positive and negative genetic changes were reported in standard tests using animals. No adverse genetic changes were reported in standard tests with human cell cultures and insects.

Ethanol

In addition to the irritating effects noted above, swallowing of ethanol also causes nervous system effects and gastrointestinal tract effects; substantial amounts may cause respiratory failure leading to death. Other effects of ethanol related to repeated intake of alcoholic beverages include nutritional deficiencies, pancreas and liver damage and blood cell changes. Repeated consumption of ethanol (alcoholic beverages) by pregnant women is reported to produce adverse effects on the development of their offspring ("fetal alcohol syndrome")

Single-dose studies indicate that ethanol is practically nontoxic orally (rats) and after skin application (rabbits) or after inhalation (rats). It is mildly to severely irritating to rabbit eyes and practically nonirritating to moderately irritating to rabbit skin. It is practically nontoxic by inhalation (rat, LC50 - 20,000 ppm, 10 hour exposure). Various morphological functions and biochemical changes in heart muscle, liver, CNS and blood cells have been reported for experimental animals given ethanol orally. Repeated inhalation exposures produced liver damage in rabbits, while other treatment-related effects were reported in pigs, dogs and monkeys. Rats exposed by skin application to a 50% solution of ethanol showed only temporary skin irritation.

Several species of laboratory animals have been exposed to ethanol by various routes to determine effects on offspring. While susceptibility varies with each species, birth defects have been consistently reported in many of the species tested (mouse, rat, pig, guinea pig, monkey). Ethanol produced genetic changes in standard tests using human volunteers and animals and yeast cells. No genetic changes were reported in standard tests using bacterial or animal cells, and negative responses were reported in assays using human cells.

Ethanol is listed as a substance which is "carcinogenic to humans" by the International Agency for Research on Cancer (IARC Monographs Vol. 44). This IRAC listing is based on their determination that although inadequate evidence exists for the carcinogenicity of ethanol and alcohol beverages in animals, sufficient evidence exists for the carcinogenicity of alcoholic beverages following long-term consumption of alcoholic beverages. Epidemiological studies report increased incidence of mouth and throat cancer in humans after long-term consumption of alcoholic beverages. Higher risk is associated with the drinking of dark liquors and for smokers who consume alcoholic beverages.

Xylene

In addition to the adverse effects noted above, swallowing of xylene may cause digestive tract irritation. Although xylene exists in different structural forms (isomers), single-dose studies using a mixture of these forms indicate that xylene is slightly toxic orally (rats) and after skin application (rabbits). It is slightly irritating to the eyes of rabbits and severely irritating to the skin of rabbits. No mortality occurred in rats exposed to mixed xylene at a concentration of 21.2 mg/l for 6 hours. Repeated application of xylene to the skin of rabbits produced irritation and skin damage. Various laboratory animals exposed to xylene by repeat inhalation at high atmospheric concentrations showed slight blood changes. Guinea pigs exposed to xylene at lower concentrations showed liver damage and lung inflammation. Rats and dogs exposed to xylene by inhalation at similar levels showed no adverse effects. Rats and mice repeatedly administered xylene orally showed no evidence of toxicity or tumor development.

No birth defects were reported in two studies with rats exposed by inhalation to mixed xylene (containing ethylbenzene); toxic effects were noted in the offspring from only one study. Birth defects occurred in mice exposed orally to mixed xylene (containing ethylbenzene) at levels that produced adverse effects and mortality in the mothers. No adverse effects on the ability of rats to reproduce was reported following repeated inhalation and oral exposures.

Limited studies indicated that no adverse genetic changes occurred in humans exposed to xylene by inhalation. No adverse genetic changes were reported in standard tests using bacterial and yeast cells, insects, animals and animal cells.

n-Methylpyrrolidone (NMP)

Human experience indicates that continued or gross skin contact with NMP produces irritation, redness and defatting of the skin. Inhalation of very high concentrations of NMP may result in headache, giddiness, nausea and mental confusion. Repeated dosing of laboratory animals with NMP has been reported to cause changes in organ weights and blood composition, reduced response to sound, and breathing difficulty at a dosage which produced death. No skin allergy was observed in guinea pigs following repeated skin exposure. Long-term inhalation (2 years) of NMP produced no increase in tumors in rats and NMP did not show tumor initiating activity in a mouse skin painting study. Birth defects were reported following dermal application of NMP to rats at amounts which produced adverse effects on the mother and following intraperitoneal injection in two strains of mice. No birth defects were reported in rats exposed to NMP by inhalation. No effects were seen on the ability of rats to reproduce when exposed to NMP for two successive generations, although toxic effects were reported in offspring at levels which produced adverse effects on the mother. NMP has produced no genetic changes in standard tests using animal and bacterial cells.

Ethylbenzene

Ethylbenzene has been reported to cause severe eye, skin and respiratory tract irritation. Prolonged skin contact with Ethylbenzene may cause blistering, and repeated contact may remove oils from the skin surface causing dryness and cracking of the skin. This component possesses narcotic-like properties; excessive exposure may result in headache, dizziness, incoordination, fatigue, nausea, loss of appetite and loss of consciousness. Coughing, choking and shortness of breath may occur if this material is accidentally drawn into the lungs during swallowing or vomiting.

No allergic skin reaction was observed in controlled skin contact studies with human volunteers. Single-dose (acute) animal studies indicate that Ethylbenzene is slightly toxic orally (rat) and practically nontoxic after skin application (rabbit). It is slightly irritating to rabbit eyes and severely irritating to rabbit skin. One out of six rats died during a single-hour exposure to Ethylbenzene vapor (30.2 mg/L) with another dying during the 14-day observation period. Rats given Ethylbenzene orally for 6 months showed liver and kidney changes.

Numerous short-term repeat inhalation studies have been conducted and report various effects in laboratory animals including increased liver or kidney weights, body weight changes, liver kidney and tests changed. The results from animal studies (rats, rabbits and monkeys) suggest that these studies are not conclusive as to the reproductive effects of Ethylbenzene. No adverse genetic changes were reported in standard tests using bacterial or yeast cells; however, genetic changes were reported in standard tests with human cell cultures.

Additional Information

A Threshold Limit Value (TLV) has been established by the American Conference of Governmental Industrial Hygienists (ACGIH) for ethanol, xylene and Ethylbenzene, the organic solvents used in Skybond 2595 polyimide resin. For further information on this material, please refer to the current edition of the Documentation of Threshold Limit Values and Biological Exposure Indices.

9. PHYSICAL DATA

Appearance:	Brown viscous liquid
Odor:	Amine-like
Solubility in Water:	Slight
Specific Gravity(H ₂ O = 1):	1.10 – 1.13

Vapor Density: 2.7
Brookfield Viscosity: 1,000 - 3,000 cps at 25°C
Vapor Pressure (mm Hg): 24
Solid after Cure (1.0±0.1g, 288°C at 1hr): 48 – 50%

Note:

These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. SPILL, LEAK & DISPOSAL INFORMATION

Waste Disposal:

SKYBOND® 2595 polyimide resin is a "hazardous waste" as that term is defined in the Resource Conservation and Recovery Act (RCRA), 40 CFR 261, "Identification and Listing of Hazardous Waste", due to its characteristics of ignitability. Disposal via incineration is required by regulation, Disposal should be in accordance with all applicable local, state and federal laws and regulations. Consult your attorney or appropriate regulatory officials for information on such disposal.

Spill or Leakage Procedures:

Remove any source of sparks, flame or hot surfaces. Insure adequate ventilation. Absorb spill with commercial absorbing materials and dispose of as recommended above. Flush area with water. Keep out of sewers, water sheds and water system.

For further information refer to DOT Emergency Response Guidebook, Guide #26.

11. ENVIRONMENTAL EFFECTS

I.S.T Corp. has not developed environmental toxicity information on SKYBOND 2595 polyimide resin. However, data are available on SKYBOND 2595 polyimide resin, a similar material:

96-hr LC50 Bluegill Sunfish: 380 mg/l, Practically Nontoxic
96-hr LC50 Rainbow Trout: 340 mg/l, Practically Nontoxic
48-hr LC50 Daphnia magna: 16 mg/l, Slightly Toxic

Date: 7/9/96

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