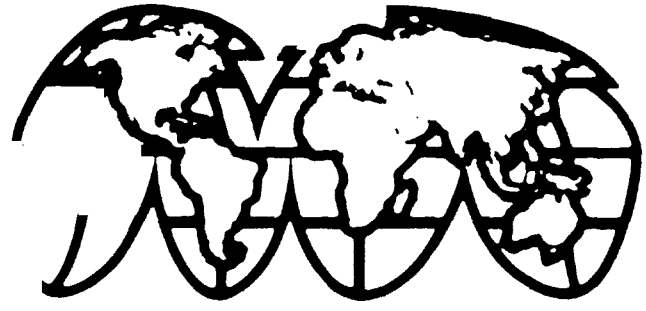
All Shields

resin

MATERIAL SAFETY DATA



LEXAN PRODUCTS DIVISION
PLASTICS GROUP
GENERAL ELECTRIC COMPANY
ONE PLASTICS AVENUE
PITTSFIELD, MA 01201

GENERAL ELECTRIC

LEXAN
resin

Issue Date **November 1985**

Supersedes Material Safety Data
Publication Dated July 1983

INTRODUCTION

This publication provides guidelines and suggested precautions for the safe handling and processing of LEXAN® resins and supersedes all previously issued material safety data sheets on these products. General Electric Company recommends that all individuals read and understand this information prior to working with LEXAN resin and that this information be incorporated into individual plant safety programs. This brochure does not include information on the suitability of LEXAN resin for any specific application nor any precautions that may be appropriate for the use of finished products. The Material Safety Data contained in this publication include all information required to be furnished by manufacturers, distributors and importers of hazardous substances by the Occupational Safety and Health Administration (OSHA) pursuant to the Hazard Communication Standard (29 CFR 1910.1200).

USER'S RESPONSIBILITY

A brochure such as this cannot cover all possible individual situations. In addition, the conditions under which our products are processed and used are beyond our control. The products described herein are not hazardous when processed properly. A user of LEXAN resin is responsible for providing a safe workplace; therefore, all aspects of an individual operation should be examined to determine if or where precautions, in addition to those described herein, are required. Any health hazard and safety information contained herein should be passed on to customers and/or employees.

Manager – Product Safety
GENERAL ELECTRICAL COMPANY
Plastics Group

GENERAL ELECTRIC

Business Office
GENERAL ELECTRIC COMPANY
Plastics Group
LEXAN Products Division
One Plastics Avenue
Pittsfield, Massachusetts 01201
Phone 1-800-GEPLAST

Manufacturing Location
Highway 69 South
Mt. Vernon, Indiana 47620
Phone (812) 838-7255

Emergency Telephone Numbers
(812) 838-7245 (24 Hours)
(413) 448-4929 (Day)

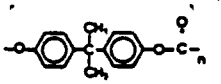
For additional non-emergency product safety information
Manager, Product Safety
General Electric Company
Plastics Technology Department
Mt. Vernon, Indiana 47620
(812) 838-7236

PRODUCT IDENTIFICATION

LEXAN® resin

The LEXAN resin family of solid organic thermoplastic resins include both Bisphenol-A-polycarbonate homopolymer and specialty copolymers based on BPA and other comonomers. The copolymers may be formulated as specialty resin grades or as components in polymer blends.

BASE RESIN (HOMOPOLYMER)

Chemical Family	Common Names	Chemical Composition	Chemical Structure	Molecular Weights
POLYCARBONATE	BISPHENOL-A-POLYCARBONATE POLY(BISPHENOL-A-CARBONATE)	CARBON 75.58% HYDROGEN 5.55% OXYGEN 18.87%	 n 45 ± 15	$\bar{M}_W$ 20,000 to 40,000 $\bar{M}_N$ 8,000 to 15,000

CHEMICAL NAMES (As Polymer)	MATERIAL FORMULA	CAS REGISTRY NUMBERS
Poly(oxycarbonyloxy-1,4-phenylene-(1-methylethylidene)-1,4-phenylene)	$(C_{16}H_{14}O_3)_n$	24936-68-3
SYNONYMS (as product of constitutent monomers)*		
Carbonic acid, polymer with 4,4'-(1-methylethylidene) bis (phenol)	$(CH_2O_3 \bullet C_{15}H_{16}O_2)_x$	25037-45-0
Carbonic dichloride, polymer with 4,4'-(1-methylethylidene) bis(phenol)	$(C_{15}H_{16}O_2 \bullet CCl_2O)_x$	25971-63-5

SPECIALTY RESINS (COPOLYMERS)

COMMON NAME: Bisphenol-A/Tetrabromobisphenol-A Copolycarbonate

CHEMICAL NAME: (as product of constitutent monomers)*

Carbonic dichloride, polymer with 4,4'-(1-methylethylidene) bis(2,6-dibromophenol) and 4,4'-(1-methylethylidene bis(phenol)	$(CCl_2O \bullet C_{15}H_{16}O_2 \bullet C_{15}H_{12}Br_4O_2)_x$	32844-27-2

COMMON NAME: Bisphenol-A/Isophthaloyldichloride/Terephthaloyldichloride Copolyester Carbonate

CHEMICAL NAME: (as product of constitutent monomers)*

1,3-Benzenedicarbonyldichloride, polymer with 1,4-benzene dicarbonyldichloride carbonic dichloride and 4,4'-(1-methylethylidene(bis(phenol)	$(C_{15}H_{16}O_2 \bullet C_8H_4Cl_2O_2 \bullet C_8H_4Cl_2O_2 \bullet CCl_2O)_x$	71519-80-7

COMMON NAME: Bisphenol-A/Trimellitic Anhydride Copolyester Carbonate

CHEMICAL NAME: (as product of constitutent monomers)*

5-Isobenzofurandicarboxylic acid, 1,3'-dihydro- 1,3 dioxo-, polymer with carbonic dichloride and 4,4'-(1-methylethylidene) bis(phenol)	$(C_9H_4O_5 \bullet C_{15}H_{16}O_2 \bullet CCl_2O)_x$	61156-92-1

* LEXAN is a Registered Trademark of General Electric Company.

LEXAN®
resin

INGREDIENTS

Commercial and proprietary compounds are added to enhance the physical and chemical properties of the base resin. These additives include (but are not limited to) the following generic classes of compounds. Most standard and developmental (designated ML-XXXX) products contain more than one type of additive.

The specific chemical identities and precise proportions of some ingredients are proprietary. This information will be made available to health professionals in accordance with the provisions of the OSHA Hazard Communication Standard.

TYPE OF ADDITIVE	FUNCTION OR PURPOSE	GENERIC COMPOUND(S) AND/OR CLASS(ES) EMPLOYED	TYPICAL LEVELS (IN PELLETS)	TYPICAL LEXAN PRODUCT DESIGNATION(S)
THERMAL STABILIZERS	Inhibit thermal degradation and discoloration	Organic phosphites Alkyl epoxides Hindered phenols	< 0.5%	101; 121; 131; 141; 141L; 151; 161; 181; 191; and all other products in the 100, 200, 300, 500, 900, 1500, 2010, 2700, 2800, 2900, 3200, 3400, BE, BL, EM, FL, HF, HW, LDS 1890, LDS 1990, LS, OQ, PPC, WR, HP, HPS, ML and RL-series.
ULTRAVIOLET STABILIZERS	Extend outdoor weathering life	Substituted benzotriazoles Benzophenones	< 0.5%	103; 123; 133; 143; 143L; 153; 163; 183; 193; 203; 303; 503; 923; 943; 953; LS1; LS2; LS3; HF1130; HF2130; QQ; FL- and specific ML- and RL- resins.
REINFORCING AGENTS	Increase strength, rigidity and dimensional stability	Glass fiber Non-asbestos minerals	5 - 50%	500; 3412; 3413; 3414; 3432; 3433; 3434; FL; BL; WR, HF, EM; PPC- and specific ML- and RL- resins.
FLAME RETARDANTS	Improve ignition resistance and reduce rate of flame spread	Organic salts Perfluoralkyl polymer	< 1%	900 series including 920; 940; 950; 920A; 940A; 950A; LEXAN C4600; and specific ML- and RL- resins.
		TBBPA copolymers Other halogenated compounds	< 8% (Halogen)	2014, 2015, 2514, 2814, 2816, 2034, 2035, 2534, BE1230, BL- and specific ML- and RL- resins.
MOLD RELEASE AGENTS	Processing efficiencies	Silicone fluids Aliphatic esters	< 0.5%	All product grade numbers with "R" Suffix as in 141R; 104R; 141LR; etc. and LDS 1890 and LDS 1990
ORGANIC POLYMERS	Property modification	Polyolefins, Polyesters Modified polyolefins, ABS Elastomeric polymers BPA-Polysiloxane copolymers	< 20%	191; 193; 194; ML4965; ML4951, BL-12, ML4980, ML5133, ML4831, etc.
BLOWING AGENTS	Foam molding	Azoheterocyclics Phenyltetrazole	< 5% (Concentrate)	All Foam Molding grades with FLC prefix as in FLC95-
COLORANTS	Standard and Custom Colors	Dyes and Pigments (See below)	< 0.1% (Transparents) < 1% (Translucents) < 3% (Opaques)	A 3 to 6 digit color number following the grade designation as in 141-112 or 104-70096

TYPE	USAGE	COMPOSITION	PRODUCT DESIGNATIONS
SPECIALTY RESINS	Flame retardance Melt stability Thermal resistance	BPA/TBBPA/Copolycarbonate BPA/TMA/Copolyester Carbonate BPA/IPC/TPC/Copolyester Carbonate	2014; 2015; ML 1754-, 150 series, PKG series PPC series

COLORANTS

Colored LEXAN resin formulations may contain commercially available dyes and pigments based on titanium dioxide, carbon black, phthalocyanines, cadmium (insoluble sulfides and sulfoselenides), lead salts, chromium (III), and other organic and inorganic compounds. In pelletized resin these colorants and the above identified additives are encapsulated in the polymer resin matrix and are not expected to create any unusual hazards when processed according to good manufacturing and industrial hygiene practices, and the enclosed guideline recommendations. (See PROCESSING FUMES.)

FDA GRADES

Specific grades of LEXAN resin (104, 124, 134, 144, 144L, 154, 164, 184, 194; 1500; PKG series and specific ML's) comply with the applicable provisions of U.S. FDA Food Additive Regulations governing food contact, (21 CFR 177.1580).

LEXAN
resin

HAZARDOUS SUBSTANCES

OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

NONE of the following materials, designated as Toxic and Hazardous Substances by the U.S. Department of Labor/ OSHA are used to produce LEXAN resin nor are they anticipated by-products in our production process.

29 CFR 1910. 1001 Asbestos
1002 Coal tar pitch volatiles
1003 4-Nitrobiphenyl
1004 alpha-Naphthylamine
1006 Methyl chloromethyl ether
1007 3.3'-Dichlorobenzidine (and salts)
1008 bis-Chloromethyl ether
1009 beta-Naphthylamine
1010 Benzidine
1011 4-Aminodiphenyl
1012 Ethyleneimine
1013 beta-Propiolactone
1014 2-Acetylaminofluorene
1015 4-Dimethylaminoazobenzene
1016 N-Nitrosodimethylamine
1017 Vinyl chloride
1018 Inorganic arsenic
1029 Coke oven emissions
1043 Cotton dust
1044 1,2-Dibromo-3-chloropropane
1045 Acrylonitrile
1047 Ethylene oxide

LEXAN resin dust is **NOT** included on the list of Toxic and Hazardous Air Contaminants (29 CFR 1910.1000). This standard does however provide the following Permissible Exposure Limits (PEL) for Inert or Nuisance Dusts. In addition Threshold Limit Values (TLV) for Some Nuisance Particulates have been established by the American Conference of Governmental Industrial Hygienists (ACGIH).

INERT OR NUISANCE DUST: 8 hour Time-Weighted-Average

	OSHA PEL	ACGIH (1984-85) TLV
Total Dust	15 mg/m³	10 mg/m³
Respirable Fraction	5 mg/m³	5 mg/m³

LEXAN resin does **NOT** contain vinyl chloride, monomeric phthalate esters, nor any EPA regulated halogenated biphenyls such as PCB's, PBB's, etc. (40 CFR 761), or chlorofluorocarbons (40 CFR 762).

TOXIC SUBSTANCES CONTROL ACT (TSCA)

LEXAN polycarbonate resin and all other chemical substances incorporated into the resin (additives, fillers, colorants and other polymeric substances) are included in the **TSCA INVENTORY OF CHEMICAL SUBSTANCES** compiled by the U.S. Environmental Protection Agency.

PHYSICAL PROPERTY DATA*

LEXAN resin, an amorphous solid, is supplied in the form of cylindrical pellets averaging 2.5 mm in diameter and 3.2 mm in length.

TEMPERATURE

GLASS TRANSITION Tg (amorphous)	150°C (302°F)
VICAT SOFTENING ASTM D-1525	152 - 157°C (306 - 315°F)
INJECTION MOLDING Typical Range	288 - 343°C (550 - 650°F)

THERMAL DECOMPOSITION	Thermogravimetric Analysis (in air)
Initial (Onset)	420°C (788°F)
50% Wt. Loss	480°C (896°F)

IGNITION TEMPERATURE	ASTM D-1929 (Setchkin Method)
Flash Ignition	449°C (840°F)
Self Ignition	632°C (1070°F)

WEIGHT

SPECIFIC GRAVITY (H_2O = 1)	Range 1.2 to 1.6
BULK DENSITY (unfilled)	Pellets 641 kg/m³ (40 lbs/ft³)

RESIN SOLUBILITY

WATER	Insoluble
METHYLENE CHLORIDE	= 20% by wt.

VOLATILES

WATER	Typical Range	0.20 ± .05% at R.T.
METHYLENE CHLORIDE		Residual Solvent < 150 ppm

COLOR AVAILABILITY

NATURAL	Transparent, water white
PIGMENTED	Unlimited; transparent to opaque

OTHER

ODOR	None to minimal
VAPOR PRESSURE	These properties are
VAPOR DENSITY	not applicable to solid
BOILING POINT	compounds such as
EVAPORATION RATE	LEXAN polycarbonate

*Typical values for general purpose grades based on material tested but may vary from sample to sample. Consult product literature for specialty grades. Typical values should not be construed as guaranteed analysis of any specific lot or as specification values.

LEXAN® resin

PROCESSING FUMES

GENERAL

Virtually all thermoplastic resins emit processing fumes when heated to extrusion or injection molding temperatures. These fumes are complex mixtures of vapors, droplets and suspended particulates which are representative of the specific resin formulation. Colorants and other additives used to enhance resin properties may be volatilized. In addition, the fumes may contain thermal decomposition products from the base resin and the various additives.

The concentration and composition of processing fume components will depend upon the processing temperature, resin formulation, residence time in the processing equipment, surface area of the molded part, equipment variables (screw design, venting parameters, etc.) and the dryness of the resin.

LEXAN RESIN

When processed according to General Electric recommended procedures, LEXAN resin processing fumes (or resin dust from secondary operations such as regrinding) are not known or expected to cause any adverse human health effects. However, the full range of potential effects has not been completely characterized. Certain sensitive individuals and individuals with respiratory impairments may be affected by exposure to specific components in the processing fumes. Such potential effects would primarily relate to the principal exposure routes – that is irritation of the eyes, nose, throat or skin (see FIRST AID Section).

The major fume components evolved by LEXAN resin at recommended processing conditions include water, carbon dioxide, diphenylcarbonate, methylene chloride and phenol. These fume components do not pose an unusual health hazard at concentrations expected in the workplace. Nevertheless, potential exposures should be minimized by good housekeeping, good industrial hygiene practice and adequate ventilation.

8 hour Time Weighted Average

	OSHA (PEL)		1984-85 ACGIH (TLV)	
	PPM	mg/m³	PPM	mg/m³
Carbon dioxide	5,000	9,000	5,000	9,000
Diphenylcarbonate	–	–	–	–
Methylene chloride	500	1,800	100	360
Phenol	5	19	5	19

VENTILATION

Ventilation requirements for each particular workplace must be determined on an individual basis. Information and guidelines on ventilation standards and design techniques may be found in the following publications.

- **NIOSH Recommended Industrial Ventilation Guidelines;** GPO #017-033-00136-7. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- **Industrial Ventilation, 18th Edition;** Available from the American Conference of Governmental Industrial Hygienists, Committee on Industrial Ventilation, P.O. Box 16153, Lansing, MI 48901.
- **Fundamentals Governing the Design and Operation of Local Exhaust Systems;** (ANSI-792.2) Available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

In general, the continuous supply of fresh air to the general workplace area together with the continuous removal of processing fume contaminated air through exhaust hoods and associated enclosed ducting will provide adequate ventilation for most operations. The exhaust hoods should be positioned to prevent routine inhalation of smoke, fumes, dust and vapors from molding and other operations.

Note: Processing fume condensates, which may include toxic contaminants, are flammable and should be periodically removed from exhaust hoods, ductwork and other surfaces. Protective clothing, including rubber gloves, should be worn during clean-up operations to prevent skin contact.

ODOR

The odor of LEXAN resin processing fumes will vary somewhat with specific resin formulations. In general, the odor is mild and not offensive to most individuals.

FIRST AID

Some individuals with specific sensitivities may exhibit eye, nose, throat or dermal irritation if overexposed to processing fumes.

Eye Irritation: Flush eyes thoroughly with clean, low pressure water.

Skin Irritation: Wash affected areas with soap and water.

Respiratory Irritation: Leave the exposure area and obtain fresh air. Provide appropriate protection before allowing re-entry.

In all cases, a physician should be contacted if irritation persists.

Note: Molten resin can cause severe thermal burns which may require expert emergency attention.

FIRE AND EXPLOSION HAZARDS

FLAMMABILITY

LEXAN resin burns with difficulty because a substantial amount of energy is required to break down the polymer into smaller fragments which will support combustion. Generally, a continuous external flame source is needed to initiate and sustain combustion. In the absence of flashover fire conditions, a LEXAN resin fire will tend to extinguish itself. Precautions similar to those taken with wood and other combustible materials are recommended.

SMOKE

When forced to burn, LEXAN resin will produce a sooty fire; that is, it will generate opaque black smoke (particulate carbon) reflecting the inherent combustion resistance of polycarbonate.

TOXICITY

The primary toxic product of combustion from LEXAN polycarbonate is carbon monoxide. Carbon dioxide, an asphyxiant, is also produced. Some flame retardant grades will evolve trace quantities of hydrogen bromide under combustion conditions. LEXAN resin does **not** produce products of combustion such as hydrogen cyanide, phosgene, acrolein, hydrogen chloride or sulfur dioxide.

FIRE FIGHTING

Water is the best extinguishing medium. Carbon dioxide is not generally recommended because its lack of cooling capacity may permit re-ignition. MSHA/NIOSH approved pressure demand breathing apparatus should be used. Personnel without suitable respiratory protection should leave the area. **Caution:** Stacked cardboard resin containers will be weakened by water absorption and may collapse.

EXPLOSION

LEXAN resin pellets, because of their size, do not present a dust explosion hazard.

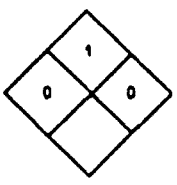
Post-molding operations, such as regrinding and sawing, should be periodically checked for proper maintenance of dust control devices. Likely sources of ignition, such as static build-up, should be eliminated. Good housekeeping and adequate ventilation can prevent accumulation of potentially explosive dust concentrations. For additional information see **NFPA 654: "Standard for the Prevention of Dust Explosions in the Plastics Industry"** published by the National Fire Protection Association (Volume Five of the National Fire Codes).

NFPA 704

NFPA FIRE HAZARD CLASSIFICATION

4 - Extreme
3 - High
2 - Moderate
1 - Slight
0 - Insignificant

LEXAN RESIN



HEALTH HAZARD DATA

None of the base resins, blending resins or elastomeric impact modifiers in the physical form present in polycarbonate-based resins are hazardous substances within the meaning of the OSHA Hazard Communication Standard.

ORAL TOXICITY

LEXAN resin has very low acute oral toxicity. When resin was administered orally as a corn oil suspension in a single dose of 5 g/kg to rats, no mortalities occurred. Necropsy revealed no outstanding gross pathological organ changes.

In subchronic testing the resin was considered physiologically inert when fed to rats for 8 weeks at a dietary level of 6%.

DERMAL TOXICITY/IRRITATION/SENSITIZATION

LEXAN resin has low acute dermal toxicity. When two different grades were tested on intact and abraded rabbit skin (200 and 2000 mg/kg occluded wrapping, 24 hr exposure), no compound-related deaths or adverse clinical observations were noted. The minimum lethal dose was rated as "greater than 2000 mg/kg".

LEXAN resin is not a primary skin irritant and does not cause systemic or local sensitization. Two different resin grades were tested for irritation potential on intact and abraded rabbit skin (500 mg, occluded wrapping, 24 hr exposure). Neither material was classified as a primary skin irritant; only minimal irritation resulted.

In a test for non-antigenicity, guinea pigs received intraperitoneal injections (3 ml every other day over a 12-day period) of saline or sesame oil extracts of LEXAN resin. After 33 days, they were challenged by a 3 ml intravenous injection or a 0.1 ml intracutaneous injection of saline extract. No systemic or local sensitization was observed.

EYE IRRITATION

LEXAN resin, in a finely divided form, is a mild eye irritant. When two different grades of LEXAN resin (pellets mechanically ground to approx. 20 mesh) were placed in the conjunctival sacs of albino rabbits (100 mg, unwashed), mild irritation occurred – consistent with the abrasive nature of the ground resin particle.

When a 0.1 ml aliquot of saline or sesame oil resin extract was similarly tested, no ocular reactions were observed – consistent with the absence of chemical irritation.

FUME INHALATION

Process fumes from typical LEXAN resins are not considered toxic. In acute exposure tests, laboratory rats were exposed to processing fumes at concentrations exaggerating those that would be likely to occur in workplace situations. No deaths or signs of toxicity except transient irritancy in some cases were noted during these 6-hour fume exposure tests. Neither were there any distinct or consistent treatment-related tissue or organ changes in gross necropsies performed after 14-day post-exposure observation periods.

HEALTH HAZARDS

There are no known acute or chronic health hazards associated with exposure to LEXAN resins, nor are there any medical conditions known to be generally aggravated by such exposure. See PROCESSING FUMES and VENTILATION section.