

Technical Bulletin

ULTRAPURE[®] Carbonates as Electrolyte Solvents



Huntsman Corporation is one of the world's largest producers of alkylene carbonates and the only producer of these products in the USA. The roots of Huntsman's carbonate experience date back to the 1950's. Huntsman technology is used to produce its carbonates in two separate manufacturing facilities on two continents. Bulk storage of the carbonate products is maintained at various sites around the world.

Alkylene carbonates are cyclic organic esters made from the reaction of ethylene oxide, propylene oxide or butylene oxide with carbon dioxide. Huntsman's core products are JEFFSOL[®] Ethylene Carbonate (EC), JEFFSOL Propylene Carbonate (PC), JEFFSOL Butylene Carbonate (BC), and JEFFSOL Glycerine Carbonate (GC).

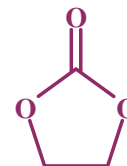
ULTRAPURE[®] Carbonates Electrolyte Solvents for Energy Storage Devices

Huntsman is the industry pioneer in process technology to produce EC and PC carbonates with the extremely high purity needed for use in lithium ion batteries and other applications such as supercapacitors. Huntsman manufactures two of the key solvents used in electrolyte formulations: Ethylene Carbonate and Propylene Carbonate sold under the ULTRAPURE[®] tradename. We have a proven expertise in reliable and cost-effective production of the ULTRAPURE[®] carbonates.

Huntsman has long held a corporate commitment to our carbonates business and to the ULTRAPURE[®] products for use in lithium ion batteries and other applications. We seek to establish close relationships with our customers and are continually looking to develop new products for the next generation of lithium ion batteries. Huntsman is dedicated to developing the latest production technology and new products for a variety of applications in electronics and energy storage. These developmental products include new cyclic carbonates and linear carbonates, as well as ionic liquids and other lithium ion battery additives such as surfactants.

ULTRAPURE[®] EC Ethylene Carbonate

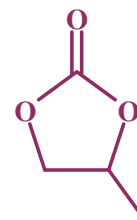
ULTRAPURE[®] EC carbonate, a practically odorless and colorless low-melting solid, is an extremely high purity solvent for applications requiring very low levels of water, glycol and other contaminants. Uses include such growing applications as lithium batteries and photochromic solutions, as well as polymer removal and other cleaning-related applications in microelectronics fabrication.



Ethylene Carbonate

ULTRAPURE[®] PC Propylene Carbonate

ULTRAPURE[®] PC carbonate, a clear, mobile, hygroscopic liquid at room temperature, is an extremely high purity propylene carbonate for solvent solutions requiring very low levels of water, glycol and other contaminants. Applications include lithium batteries, condensers, photochromic solutions, polymer removal for microelectronics, and other related electrochemical applications.



Propylene Carbonate

Manufacturing Capabilities

North America

Huntsman is the widely recognized leader and the only producer of alkylene carbonates (ethylene, propylene and butylene carbonates) in North America. Our world-scale manufacturing facility is located in Conroe, Texas, just north of Houston. The plant is an ISO-certified facility with a commitment to safety, environmental responsibility, quality, customer focus, and the community. This facility was at the forefront of the development of ultra high purity ethylene and propylene carbonates (sold under the ULTRAPURE[®] tradename) for the electronics and lithium ion battery industry. Our state of the art process control systems enable Huntsman to reliably and cost-effectively produce the ULTRAPURE[®] carbonate products.

Asia

In addition to production in the USA, Huntsman's proven technology for production of ULTRAPURE[®] carbonates is now being practiced in the Asia Pacific region to provide a local supply to APAC markets. The reliable Huntsman technology critical to manufacturing high purity ethylene and propylene carbonates has been replicated at the production site in China, providing the same reliability and quality customers have come to appreciate with our North American production facility to the Asia Pacific market.

Product Specifications

	ULTRAPURE[®] EC Carbonate	ULTRAPURE[®] PC Carbonate
Appearance	Clear when molten; substantially free of suspended matter	Clear and substantially free of suspended matter
Color, Pt-Co	20 max. (molten)	20 max.
Assay, wt%	99.99 min.	99.99 min.
Glycol, ppm	20 max.	20 max.
Residual Oxide, ppm	No spec	20 max.
Water, ppm	20 max.	20 max.

In addition to the ultra high purity grades of ULTRAPURE[®] EC and PC carbonates, Huntsman also offers battery grade versions of both products, sold as ULTRAPURE[®] EC-BG and PC-BG carbonates.

	ULTRAPURE[®] EC-BG Carbonate	ULTRAPURE[®] PC-BG Carbonate
Appearance	Clear when molten; substantially free of suspended matter	Clear and substantially free of suspended matter
Color, Pt-Co	20 max. (molten)	20 max.
Assay, wt%	99.95 min.	99.95 min.
Glycol, ppm	50 max.	50 max.
Water, ppm	50 max.	50 max.

Regulatory, Hazard and Transportation Information

	Ethylene Carbonate	Propylene Carbonate
DOT/TDG Classification	Not Regulated	Not Regulated
HMIS Code	2-1-0	1-1-0
CAS RN	96-49-1	108-32-7
WHMIS Classification	D1B, D2A	D2B

Physical and Typical Properties

	Ethylene Carbonate	Propylene Carbonate
Boiling point, 760 mm Hg, °C (°F)	248 (478)	242 (468)
Dielectric constant, esu	89.6 (40°C)	65 (25°C)
Flash point, PMCC, °C (°F)	152 (306)	135 (275)
Freeze point, °C (°F)	36 (97)	-49 (-56)
Molecular weight	88	102
pH (aqueous solution)	7	7
Specific gravity	1.3 (40/40°C)	1.2 (20/20°C)
Specific resistance, ohm-cm, 40°C	1-10 x 10 ⁷	1-8 x 10 ⁶
Vapor pressure, mm Hg, 20°C (68°F)	<0.01	0.02
Viscosity, cSt, 40°C (104°F)	1.5	1.6 (43.3°C, 110°F)
Weight, lb/gal, 20°C (68°F)	11.0	10.1

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