Diethylzinc - DEZn TCO

for Thin Film Solar Cells

AkzoNobel
Tomorrow's Answers Today

Welcome to AkzoNobel

AkzoNobel is proud to be one of the world's leading industrial companies.

In fact, we are the largest global paints and coatings company. As a major producer of specialty chemicals we supply industries worldwide with quality ingredients for life's essentials. We think about the future, but act in the present. We're passionate about introducing new ideas and developing sustainable answers for our customers.

That's why our 60,000 employees - who are based in more than 80 countries - are committed to excellence and delivering **Tomorrow's Answers Today™**.

A long history

We have a long history in metal alkyls, starting with large-scale production of aluminum alkyls in 1959. Today, we're one of the world's top producers with a broad range of metal alkyls, including aluminum, magnesium, boron and zinc alkyls. Our ultra-high purity semiconductor-grade product range includes indium-, aluminum-, zinc- and antimony-based MO-sources.

We are the only fully integrated high purity metalorganics supplier serving the semiconductor industry, producing our own trimethyl aluminum, a key raw material for these products.

AkzoNobel also plays a role in the fast-growing solar cell market. We have developed new technology for the production of high purity diethyl zinc, which is used by thin film solar cell manufacturers to create the all-important TCO layer. It is our contribution to solar energy, for the benefit of our planet.

At AkzoNobel we look beyond horizons. We believe that what is good for you today is not necessarily good for you tomorrow. We are committed to the success of our customers. That's why we continually invest in high-quality standards, innovation, safety, active technical support and better distribution systems.

AkzoNobel Polymer Chemicals is a leading global producer of innovative organic peroxides, metal alkyls, organometallic specialties and polymer additives. Headquartered in Chicago in the United States, we supply essential products used in the production of thermoplastic resins, and thermoset and elastomeric materials.

Focused on addressing our customers' future needs, we operate sites all around the world and adopt the highest HSE standards while remaining committed to developing sustainable processes and technologies.

AkzoNobel pioneered the large-scale production of diethyl zinc (DEZn) and has been producing commercial quantities in La Porte (Tx - USA) since the 1960s. Main applications are as ZnO precursor for the TCO layer in thin film solar cells and in pharmaceutical synthesis. Our product grade specifically aimed to serve the needs of the solar cell industry is called DEZn TCO.

A secure partner

Recognizing increasing worldwide requirements, we expanded capacity in 1996 with the construction of a major metal alkyl manufacturing facility near Rotterdam, The Netherlands. We now produce diethyl zinc, including the TCO grade, at both our La Porte and Rotterdam site, thus ensuring security of supply to our global customer base.

We also supply a range of other metal alkyls from our La Porte and Rotterdam sites, as well as from smaller facilities in Tianjin (China), Mahad (India) and Paulinia (Brazil). Our global distribution network allows us to deliver products to you anywhere in the world. That's how we ensure a reliable supply chain and easy access to quality products wherever you are.

All our sites are ISO 9001 and ISO 14001 certified to ensure the highest product quality and strict compliance with environmental regulations. Additionally, La Porte is an OSHA VPP Star site and both Rotterdam and Paulinia have achieved OHSAS 18001 certification. Our sites in the Americas have achieved RC 14001 certification as well.

- Regional headquarters
- Manufacturing sites
- Distribution centers
- R&D sites

DEZn TCO product data

AkzoNobel uses leading edge processes, purification and transfilling techniques that ensure the repeatable and consistent delivery of the highest purity DEZn TCO in each cylinder that we supply. We apply state of the art techniques such as ICP-AES for trace metal analysis to meet customer's demands. Product specifications are provided on our Product Data Sheet (PDS), available at www.akzonobel.com/hpmo. Please contact your AkzoNobel sales representative for more information.

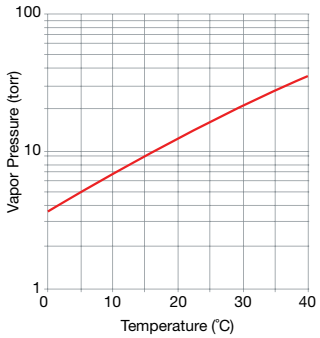
Product description	
Molecular formula	$(C_2H_5)_2Zn$
Molecular weight	123.50
CAS No.	557-20-0
EINECS/ELINCS No.	209-161-3
TSCA status	listed on inventory
UN No.	3394

Characteristics	
Appearance	colorless liquid
Density, 30°C	1.198 g/ml
Melting point	-30°C
Viscosity, 20°C	0.7 mPa.s
Boiling point, 760 torr	118°C
Stability to air	ignites upon exposure
Stability to water	reacts violently
Solubility	soluble in aromatic and saturated aliphatic and cycloaliphatic hydro-carbons

Thermochemical properties	
Specific heat, 57°C	1.502 J/g.°C (0.359 cal/g.°C)
Heat of vaporization △Hv, at 118°C	326 J/g (78 cal/g)
Heat of hydrolysis, 25°C	2117 J/g (506 cal/g)
Heat of formation △Hf°, 25°C, 1 bar	17 kJ/mole (4 kcal/mole)
Heat of combustion △Hc°, 25°C	-3364 kJ/mole (-804 kcal/mole)

Vapor pressure	
at 10°C (283.15 K)	6.79 torr
at 20°C (293.15 K)	12.2 torr

Gas constants	log P(torr)=B-A/T(K)
A	2109
B	8.28



Shipping containers

We maintain a fleet of cylinders and portable tanks designed for the shipment of DEZn TCO. Shipping containers are designed and constructed to meet all national and international transport regulations and are tested periodically, in accordance with the appropriate regulations. Containers are fabricated from carbon steel and are equipped with dip tubes for top discharge. Valves are equipped with standard VCR connections.

Cylinder	Max. filling weight (90%)	Dimensions	
		Diameter	Height
Pyrosafe	1 kg (2.2 lb)	9.0 cm (3.562 in)	26.7 cm (10.5 in)
B-2	11.8 kg (26.0 lb)	23.2 cm (9.125 in)	46.4 cm (18.25 in)
B-5	24 kg (52.9 lb)	30.8 cm (12.125 in)	53.3 cm (21 in)
B-28	116 kg (256 lb)	37.1 cm (14.625 in)	129.5 cm (51 in)
B-118	476 kg (1049 lb)	71.1 cm (28 in)	145.7 cm (57.375 in)

Portable tank	Max. filling weight (90%)	Dimensions		
		Length	Diameter	Height
C-430 saddle type	1755 kg (3869 lb)	208 cm (82 in)	107 cm (42 in)	128 cm (50.5 in)
C-1980	8081 kg (17816 lb)	305 cm (120 in)	190 cm (74.8 in)	224 cm (88.2 in)
ISO*	23001-25338 kg (50709-55861 lb)	606 cm (239 in)	244 cm (96 in)	259 cm (102 in)

* Exact volume of an ISO tank container depends on the model

Safety: Our top priority

AkzoNobel's success in safely handling DEZn is due to our long-term commitment to safety. Knowledge of proper handling techniques, carefully designed facilities and thorough training of personnel can overcome the hazards. Personnel who understand and pay proper attention will be able to handle metal alkyls confidently and safely.

Safety and Handling

DEZn ignites upon exposure to air and reacts violently with water. DEZn must be handled under a dry, inert atmosphere, e.g. nitrogen or argon. DEZn may undergo exothermic decomposition with evolution of flammable gas if stored above 70°C (158°F). The decomposition may become self-accelerating and UNCONTROLLABLE and may result in an explosion if heated above 120°C (248 °F). Water must be scrupulously removed from process equipment prior to putting it into metal alkyls service. Failure to do so may result in an explosion. Products of complete combustion of DEZn are zinc oxide, carbon dioxide and water. DEZn causes severe burns to the skin and eyes. It is imperative that proper personal protective equipment be worn when handling DEZn.

Storage

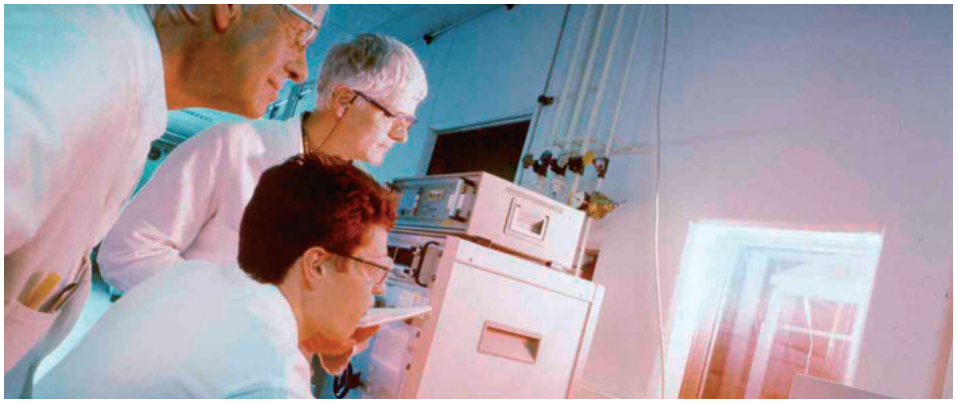
DEZn is stable when stored under a dry, inert atmosphere and away from heat. DEZn may undergo violent exothermic decomposition with flammable gas evolution if stored at temperatures above 70°C (158°F).

Safety Services

AkzoNobel is recognized as a global leader in metal alkyl safety. We always place safety as our top priority. Sharing our experience in safety is one of the most important resources we offer. Through our safety programs we can provide expert advice on the handling of these materials including:

- classroom review of safety and handling of metal alkyls
- consultation of metal alkyl facility design
- demonstrations on the safe use, handling and control of metal alkyls
- on-site assistance and advice regarding procedures

As such, we routinely advise our customers on the development of systems which deliver DEZn from our bulk containers to their production tools and the safety procedures that should be employed in these production processes. Please contact us if you are interested in such services.



Protection for human and animal health and the environment is an integral part of the way we do business. Backed up by our commitment to Responsible Care®, Product Stewardship and REACH, we believe that supplying the right chemistry goes beyond just selling products.

AkzoNobel is ranked as one of the chemicals industry leaders on the prestigious Dow Jones Sustainability World Indexes (DJSI), recognizing our ongoing commitment to improving its social responsibility performance.

Your global Akzo Nobel HPMO team is here to serve you. For more information, please contact your sales manager or regional Akzo Nobel sales office.

Americas
Akzo Nobel Polymer Chemicals LLC
525 West Van Buren Street
Chicago, IL 60607
United States
T +1 800 828 7929 (US only)
T +1 312 544 7000
F +1 312 544 7188
E metalorganicsNA@akzonobel.com

Asia Pacific
Akzo Nobel (Asia) Co., Ltd.
United Plaza, 3rd Floor
1468 Nanjing Road West
Shanghai 200040
P.R. China
T +86 21 62793399
F +86 21 62471129
E metalorganicsAP@akzonobel.com

Europe, Middle East, India and Africa
Akzo Nobel Polymer Chemicals B.V.
Stationsstraat 77
P. O. Box 247
3800 AE Amersfoort
The Netherlands
T +31 33 467 6767
F +31 33 467 6100
E metalorganicsEU@akzonobel.com

Internet
www.akzonobel.com/hpmo

Additional information

Product Data Sheets (PDS) and Material Safety Data Sheets (MSDS) are available at www.akzonobel.com/hpmo

On request we also provide specific publications on subjects such as the safe use and storage of metal alkyls, facilities design and maintenance, and unloading procedures.

www.akzonobel.com/hpmo

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