

# CdSe/ZnS Core Shell in Polymethyl Methacrylate Toluene Solution

MSDS

## Section 1 - Chemical Product

Product Family #:	CdSe-PMMA
Substance:	Toluene and poly(methylmethacrylate) (PMMA) with Cadmium Selenide nanocrystal compound
Trade Names/Synonyms:	Core/Shell Evidots in PMMA and Toluene
Chemical Family:	Matrix: hydrocarbon, aromatic Nanocrystal: II-VI semiconductor compound

## Section 2 - Composition, Information on Ingredients

Component	CAS#	EC#	% By Weight
Toluene	108-88-3	203-625-9	85-95
Polymethyl methacrylate (PMMA)	9011-14-7	none	5-15
Cadmium Selenide (as nano-crystal compound)	1306-24-7	215-148-3	~ 1-3

## Section 3 - Hazards Identification

Hazard Description:	Toxic, Dangerous to the Environment
NFPA Rating:	Health = 2 Fire = 3 Reactivity = 0

Emergency Overview	
Color:	Yellow-brown
Physical Form:	Liquid
Odor:	Distinct aromatic odor
Major Health Hazards:	Respiratory tract irritation, skin irritation, eye irritation, aspiration hazard, central nervous system depression, nerve damage.

Emergency Overview			
Physical Hazards:	Flammable		
Potential Health Effects			
Inhalation:	Irritation, nausea, headache, drowsiness, dizziness, disorientation, sleep disturbances, loss of coordination, dilated pupils, kidney damage and liver damage, cancer.		
Skin Contact:	Irritation		
Eye Contact:	Irritation		
Ingestion:	Nausea, stomach pain, headache, drowsiness, dizziness, disorientation, sleep disturbances, loss of coordination, dilated pupils, kidney damage, liver damage, aspiration hazard.		
Carcinogen Status:	Toluene	Cadmium Compounds	PMMA
OSHA:	No	Yes	No
NTP:	No	Yes	No
IARC:	No	Yes	No

## Section 4 - First Aid Measures

Inhalation:	If inhaled, remove to fresh air. If not breathing give artificial respiration and seek medical attention.
Skin Contact:	Wash skin with soap and water for at least 15 minutes while removing contaminated personal protective equipment, clothing and shoes. Seek medical attention if needed.
Eye Contact:	Irrigate eyes for at least 15 minutes. Seek medical attention.
Ingestion:	If ingested, do not induce vomiting, seek medical attention immediately.

## Section 5 - Fire Fighting Measures

Extinguishing Media:	Dry chemical, carbon dioxide and foam extinguisher
Fire Fighting:	Avoid Inhalation of material or combustion by-products
Flash Point:	39F (4C) (closed cup)
Flammable Limits:	1.2% LEL -7.1% UEL
Autoignition Point:	896 F (480 C)
Flammability Class:	OSHA Class IB

## Section 6 - Accidental Release Measures

Small Spills:	Utilize personal protective equipment as described in section 8 and absorb with spill pillow or other non-combustible material. Collect spilled material in appropriate container for disposal.
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## Section 7 - Handling and Storage

Use good hygienic work practices and wash hands after use. Store in a tightly closed container. Store in a cool dry place.

## Section 8 - Engineering Controls & Personal Protective Equipment

Exposure Limits	
Toluene	200ppm OSHA TWA PEL 300ppm ceiling OSHA 50ppm ACGIH TWA (skin) 100ppm (375 mg/m <sup>3</sup> ) NIOSH TWA 10hour 190mg/m <sup>3</sup> DFG MAK 50ppm (191 mg/m <sup>3</sup> ) UK OES TWA
PMMA	No personal exposure limits established
Cadmium compounds (as Cd):	5 ug/m <sup>3</sup> OSHA TWA (metal and compounds) 2.5 ug/m <sup>3</sup> OSHA action level (metal and compounds) 0.2 mg/m <sup>3</sup> OSHA TWA (dust) (where cadmium standard 1910.1027 is not in effect) 0.6 mg/m <sup>3</sup> OSHA ceiling (dust) (where cadmium standard 1910.1027 is not in effect) 0.01 mg/m <sup>3</sup> ACGIH TWA (compounds and metal) 0.002 mg/m <sup>3</sup> ACGIH TWA (respirable particulate, compounds and metal) 0.015 mg/m <sup>3</sup> AGS TRK (inhalable dust fraction) (others) 0.025 mg/m <sup>3</sup> UK MEL TWA (metal and compounds)
Selenium compounds (as Se):	0.2 mg/m <sup>3</sup> OSHA TWA 0.2 mg/m <sup>3</sup> ACGIH TWA 0.2 mg/m <sup>3</sup> NIOSH recommended TWA 10 hour(s) 0.05 mg/m <sup>3</sup> DFG MAK (peak limitation category - II, with excursion factor of 4) (inhalable dust fraction) (metal and inorganic compounds) 0.1 mg(Se)/m <sup>3</sup> UK OES TWA

Ventilation:	Provide local exhaust ventilation system or work in a chemical fume hood. Considerations should be made for the use of non-sparking or intrinsically safe ventilation systems and equipment if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.
Eye Protection:	Wear safety glasses with side shields as a minimum level of protection. If splash or splatter is possible, wear chemical/splash resistant safety goggles and or face shield. Emergency eye wash station and quick drench shower should be provided in the immediate work area as per the ANSI Z358.1 guidelines.
Clothing:	Wear appropriate chemical resistant clothing.

Gloves:	Wear appropriate chemical resistant gloves for type of exposure. (polyvinyl alcohol, Teflon™ and Viton™ gloves are resistant to toluene exposure)
Respirator:	Refer to 29CFR1910.134 for selection of appropriate respiratory protection. Organic vapor cartridge with a ½ or full face mask, where toluene vapors do not exceed the assigned protection factor for the respirator. For unknown concentrations or IDLH atmospheres wear self-contained breathing apparatus or supplied air with escape bottle.

## Section 9 - Physical & Chemical Properties

Cadmium Selenide Core Shell EviDots in Toluene and PMMA	
Physical State:	Liquid
Color:	Yellow-Brown
Odor:	Distinct aromatic odor
Odor Threshold:	~10-15 ppm
Molecular Weight:	92.14
Boiling Point:	232F (111 C)
Freezing Point:	-139 F (-95 C)
Vapor Pressure:	22mmHg @20C
Vapor Density ( air = 1 ):	3.14
Specific Gravity ( water = 1 ):	0.8669
pH:	No data available

## Section 10 - Reactivity

Stability:	Stable at standard temperatures and pressure.
Conditions to avoid:	Avoid heat, sparks and other sources of ignition.
Incompatible:	Incompatible with oxidizing materials, halogens, acids, combustible materials and metal salts
Hazards Decomposition:	Combustion produces toxic by-products.
Polymerization:	Will not polymerize.

## Section 11 - Toxicological Information

Toluene	
Irritation Data:	300 ppm eyes-human; 435 mg skin-rabbit mild; 500 mg skin-rabbit moderate; 20mg/24hours skin-rabbit moderate
Toxicity Data:	719ul/kg oral-man LDLo; 50 mg/kg oral-human LDLo; 200 ppm inhalation-human TCLo; 100 ppm inhalation-man TCLo; 636 mg/kg oral-rat LD50; 49 gm/m <sup>3</sup> /4 hours inhalation-rat LC50; 1332 mg/kg intraperitoneal-rat LD50; 1960 mg/kg intravenous-rat LD50; 6900 mg/kg unreported-rat LD50; 400 ppm/24hours inhalation-mouse LC50; 59 mg/kg intraperitoneal-mouse LD50; 2250 mg/kg subcutaneous-mouse LD50; 2gm/kg unreported-mouse LD50; 14100ul/kg skin-rabbit LD50; 130mg/kg intravenous-rabbit LDLo; 1600 ppm inhalation-guinea pig LCLo
Local Effects:	Irritant; inhalation, skin, eye
Slightly Toxic:	Inhalation & dermal absorption
Moderately Toxic:	Ingestion
Target Organs:	Nervous system

Cadmium Compounds	
Acute Inhalation:	Exposure to sufficiently high concentrations of cadmium dusts may result in upper respiratory tract irritation with delayed symptoms of cough, sore throat, wheezing, headache, chest pain, dizziness, abdominal pain, nausea, diarrhea and vomiting. Exposure may also cause sweating, chills, and difficulty in breathing. Severe exposures may result in lung, kidney or liver damage or death from massive pulmonary edema.
Chronic Inhalation:	Cadmium is highly cumulative and respiratory effects from repeated or prolonged exposure to dusts or fumes may include rhinitis, bronchitis, emphysema, cough, dyspnea, abnormal lung function, obstructive disease, and possibly fibrosis. Ulceration of the nasal septum and yellow discoloration of the teeth may occur. Cadmium induced kidney damage is irreversible and may progress after exposure ceases; some cases of progression to kidney failure have been described. Osteomalacia, osteoporosis, and spontaneous and pseudofractures may occur and may be manifested as back pain, pain in the extremities, difficulty in walking, and pain on bone pressure. Other effects may include irritability, weight loss, fatigue, mild to moderate anemia, eosinophilia, damage to the olfactory nerve with anosmia, and liver damage. An epidemiological study suggests a relationship between cadmium levels in air and cardiovascular disease, but a causal association has not been proved. Occupational exposure to cadmium is implicated in a significant increase in the incidence of prostatic and respiratory cancers.
Acute Ingestion of Cadmium Compounds:	The persistent vomiting induced by cadmium compounds may limit the amount retained, but if sufficient amounts are absorbed, symptoms of systemic toxicity may begin within 15 minutes to 2 hours. Salivation, choking, severe nausea, abdominal pain, diarrhea, tenesmus, blurred vision, dizziness, headache, muscular cramps, exhaustion, collapse, shock, unconsciousness and rarely, convulsions may occur. Recovery may begin within 5-10 hours; sequelae may include delayed liver and kidney damage. Single doses of 10-20 mg of soluble cadmium salts have induced severe toxic effects and doses above 300 mg may be fatal. Death due to shock and dehydration may occur within 24 hours or may be delayed 7-14 days and be due to renal failure or cardiopulmonary depression.
Chronic Ingestion of Cadmium Compounds:	Cadmium accumulates in the body and prolonged low level exposure may cause irreversible renal tubular dysfunction and bone effects as described in the chronic inhalation section.
Moderately Toxic:	Ingestion
Target Organs:	Nervous system

Selenium Compounds	
Acute Inhalation:	May cause irritation and inflammation of the upper respiratory tract, redness of mucous membranes, sneezing, coughing, sore throat, metallic taste in the mouth, and gastrointestinal distress. Exposure to high concentrations of fumes may cause dyspnea and possibly slight tracheobronchitis. Central nervous effects may include frontal headaches, nervousness, convulsions, and death from respiratory depression.

<b>Selenium Compounds</b>	
<b>Chronic Inhalation:</b>	Repeated or prolonged exposure may result in a metallic taste in the mouth followed by a garlic odor of the breath and sweat. Other symptoms may include pallor, coated tongue, gastrointestinal disturbances including nausea, vomiting, abdominal pain, diarrhea, weight loss, lumbar pain, depression, lassitude, fatigue, giddiness, and emotional instability. Liver and spleen effects and albuminuria, porphyrinuria, and urobilinuria have also been reported.
<b>Acute Skin Exposure:</b>	Contact with selenium compounds may cause irritation, rashes and skin eruptions. Some compounds are strong vesicants and can cause destruction of skin and possibly burns.
<b>Chronic Skin Exposure:</b>	Repeated or prolonged exposure to light dust concentrations of selenium compounds may cause dermatitis, paronychia, and skin eruptions. Some selenium compounds are absorbed through the skin and may result in effects as detailed in the inhalation section.
<b>Acute Ingestion:</b>	Ingestion may cause severe irritation and disturbances of the gastrointestinal tract, metallic taste in the mouth, tachycardia, chills, and central nervous system effects as detailed in acute inhalation.
<b>Chronic Ingestion:</b>	Repeated or prolonged ingestion may result in a metallic taste in the mouth, garlic odor of breath and sweat, and other symptoms as described in chronic inhalation. Additional effects reported from ingestion of food and water containing excessive amounts of selenium include skin hyperpigmentation, nail changes, gingivitis, excess dental caries, malocclusion, weight loss, vestibulotoxicity, amyotrophic lateral sclerosis, arthritis, problems walking, diminished reflexes, substernal pain, disturbances of respiratory and endocrine function, jaundice, hepatic disease, and socio-psychologic effects. In extreme cases, loss of nails and hair, numbness and incoordination of arms and legs, paralysis, lack of mental alertness and death from respiratory paralysis may occur.
<b>Additional toxicological information:</b>	To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. Cadmium Selenide, in the form of a nanocrystal may or may not present the same health hazards as a larger cadmium or selenium containing molecules. It is therefore encouraged to use caution when handling this product as its toxicity and modes of exposure are not well characterized or understood.

<b>PMMA</b>	
<b>Health effects:</b>	No significant adverse effects are known. In solid form, may cause irritation when inhaled or ingested or with eye and skin contact. No data available for chronic or acute effects.
<b>Additional toxicological information:</b>	To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. Cadmium Telluride or Cadmium Selenide in the form of a nanocrystal may or may not present the same health hazards as a larger Cadmium, Tellurium or Selenium containing molecules. It is therefore encouraged to use caution when handling this product as its toxicity and modes of exposure are not well characterized or understood.

## Section 12 - Ecological Information

Do not allow material to be released to the environment (ground, air or water bodies) without proper permits. Toluene is not persistent in the environment.

## Section 13 - Transportation Information

U.S. DOT:	Class 3, packing group II, UN1294
Canadian Transportation of Dangerous Goods:	UN 1294 Class 3
Land Transport ADR/RID:	UN1294, Class 3, Class Code F1, Pack group II
Air Transport IATA/ICAO:	UN1294, Class or Division 3, pack group II
Exceptions:	49 CFR 173.4

## Section 14 - Disposal

U.S. EPA 40 CFR 262: Hazardous Waste Number: D001 (Flammable), U220 (toluene)  
Dispose in accordance with all applicable local, state and federal regulations.

## Section 15 - Regulatory Information

### US Regulations

**Toluene:**  
 CERCLA: 1000 Lbs RQ  
 SARA Title III, sec. 302, 304: Not regulated  
 SARA Title III, Section 311/312  
 Acute: Yes  
 Chronic: Yes  
 Fire: No  
 Reactive: No  
 Sudden Release: No  
 US Inventory (TSCA) listed: Yes

### Canadian Regulations

WHMIS Classification: Not available

### European Regulations

EC Classification:  
 F Highly Flammable  
 Xn-Harmful

### EC Risk Phrases

R11, R20, S2, S16, S25, S29, S33

## Section 16 - Other Information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Evident Technologies shall not be held liable for any damage resulting from handling or from contact with the above product. See packing slip for additional terms and conditions of sale.

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