

MATERIAL SAFETY DATA SHEET

I301 Perovskite ink (DMF, DMSO PbI₂, FAI, PbBr, MABr)



1: Identification of the substance/mixture and of the company/undertaking

Product Details

Product Code : I301
Name : I301 Perovskite Precursor Ink
REACH No. : Not applicable
CAS No. : Not applicable

Supplier details

Supplied by : Ossila Limited
Kroto Innovation Centre
Broad Lane, Sheffield
S3 7HQ, UK
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2. Hazards identification

2.1. Classification of the substance or mixture

Hazard statements according to Regulation (EC) 1272/2008

Flammable liquids (Category 3)
Reproductive toxicity (Category 1A)
Acute toxicity (Category 4)
Acute toxicity, Oral (Category 4)
Acute toxicity, Inhalation (Category 4)
Eye irritation (Category 2)
Specific target organ toxicity – repeat exposure (Category 2)
Specific target organ toxicity – single exposure (Category 3), Respiratory system
Acute aquatic toxicity (Category 1)
Chronic aquatic toxicity (Category 1)

2.2. Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]

Pictogram



Signal word Danger

Hazard statement(s)

H226 Flammable liquid and vapour.
H302 Harmful if swallowed.
H312 Harmful in contact with skin.
H315 Causes skin irritation
H319 Causes serious eye irritation.
H332 Harmful if inhaled.

H335	May cause respiratory irritation.
H360Df	May damage the unborn child. Suspected of damaging fertility.
H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P260	Do not breath dust/ fume/ gas/ mist/ vapours/ spray.
P280	Wear protective gloves/protective clothing.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/attention.

Supplemental Hazard Statements Restricted to professional users.

2.3. Other hazards

Rapidly absorbed through the skin.

3. Composition/Information on ingredients

3.2. Mixtures

Synonyms : Lead bromide, methylammonium bromide, lead iodide, formamidinium iodide solution

Hazardous ingredients according to Regulation (EC) No 1272/2008

Component	CAS #	Weight %	CLP Classification
N,N-Dimethylformamide (DMF)	68-12-2	< 40 %	Flam. Liq. 3; Repr. 1B; Acute Tox. 4 *; Acute Tox. 4 *; Eye Irrit. 2; H226, H360D, H332, H312, H319
Dimethylsulfoxide (DMSO)	67-68-5	<10%	
Lead Bromide (PbBr ₂)	10031-22-8	< 5 %	Acute Tox. 4; Repr. 1A; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H332, H360Df, H373, H400, H410 Concentration limits: ≥ 2.5 %: Repr. 2, H361f; ≥ 0.5 %: STOT RE 2, H373; M-Factor - Aquatic Acute: 10
Lead Iodide (PbI ₂)	10101-63-0	<33%	Acute Tox. 4; Repr. 1A; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H332, H360Df, H373, H400, H410 Concentration limits: ≥ 2.5 %: Repr. 2, H361f; ≥ 0.5 %: STOT RE 2, H373; M-Factor - Aquatic Acute: 10
Formamidinium iodide (FAI)	879643-71-7	< 12 %	
Methylammonium Bromide (MABr)	6876-37-5	<2%	Acute Tox. Or. 4; Skin Irrit. 2; Eye Irrit. 2; STOT SE 3; H302, H315, H319, H335

4. First aid measures

4.1. Description of first aid measures

After Inhalation

If inhaled, remove to fresh air. If not breathing give artificial respiration. Call a physician.

After skin contact

In case of skin contact, wash with soap and flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

After eye contact

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

After Ingestion

If swallowed, wash out mouth with water. Call a physician.

4.2. Most important symptoms and effects, both acute and delayed

Lead salts have been reported to cross the placenta and to induce embryo- and feto- mortality. They also have teratogenic effect in some animal species. No teratogenic effects have been reported with exposure to organometallic lead compounds. Adverse effects of lead on human reproduction, embryonic and fetal development, and postnatal (e.g., mental) development have been reported. Excessive exposure can affect blood, nervous, and digestive systems. The synthesis of hemoglobin is inhibited and results in anemia. If left untreated, neuromuscular dysfunction, possible paralysis, and encephalopathy can result. Additional symptoms of overexposure include: joint and muscle pain, weakness of the extensor muscles (frequently the hand and wrist), headache, dizziness, abdominal pain, diarrhea, constipation, nausea, vomiting, blue line on the gums, insomnia, and metallic taste. High body levels produce increased cerebrospinal pressure, brain damage, and stupor leading to coma and often death.

Intolerance for alcohol can occur up to 4 days after *N,N*-dimethylformamide exposure, which is considered to be a potent liver toxin. Vomiting, diarrhoea and abdominal pain can occur after exposure. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

4.3. Indication of any immediate medical attention and special treatment needed

No data available.

5. Fire fighting

5.1. Extinguishing media

Suitable extinguishing media: Dry chemical, alcohol-resistant foam, carbon dioxide or water spray. Consult with local fire authorities before attempting large scale fire fighting operations.

5.2. Special hazards arising from the substance of mixture

Hazardous combustion products: Carbon oxides, nitrogen oxides and may produce hydrogen chloride gas and lead oxides when burnt.

5.3. Advice for firefighters

Wear a self-contained breathing apparatus if necessary. During a fire, irritating and highly toxic gases and vapours may be generated by thermal decomposition.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Wear personal protective equipment (section 8). Avoid breathing in vapours. Ensure room is well ventilated. Remove all sources of ignition.

6.2. Environmental precautions

Do not let product enter drains. Discharge into the environment must be avoided.

6.3. Containment and cleaning

Contain and clean up spill if safe to do so using an electrically protected vacuum cleaner or by wet-brushing. Dispose of dry waste in closed container for proper disposal according to local regulations.

7. Handling and storage

7.1. Precautions for safe handling

Obtain special instructions before use. Avoid prolonged or repeated exposure. Avoid contact with eyes, skin, and clothing. Avoid inhalation of vapour or mist. Provide appropriate exhaust ventilation at places where vapour or mist is formed. Keep away from sources of ignition and avoid the build of electrostatic charge. In case of an accident or if you are feeling unwell, immediately seek medical advice.

7.2. Conditions for safe storage, including any incompatibilities

Store in a dark, cool, dry place and well-ventilated place inside of a tightly sealed container. Reseal containers that have been opened and keep upright to prevent leakage. Good industrial practice in housekeeping and personal hygiene should be followed.

Quality-related information: Product is air and moisture sensitive. Product is hygroscopic. Handle and store under inert gas.

7.3. Specific end uses

No data available.

8. Exposure controls / Personal protection

8.1. Control parameters

Safety shower and eye bath. Mechanical exhaust required.

Exposure limit sources

UK – EH40 Workplace Exposure Limits (WEL).

Components with workplace control parameters

Component	CAS #	Value	Control parameters	Basis
N,N-Dimethylformamide	68-12-2	STEL	20 ppm, 61 mg/m ³	UK. EH40 WEL – Workplace Exposure Limits
		TWA	10 ppm, 30 mg/m ³	UK. EH40 WEL - Workplace Exposure Limits
		TWA	5 ppm, 15 mg/m ³	Europe. COMMISSION DIRECTIVE 2009/161/EU establishing a third list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Commission Directive 2000/39/EC

Component	CAS #	Value	Control parameters	Basis
		STEL	10 ppm, 30 mg/m ³	Europe. COMMISSION DIRECTIVE 2009/161/EU establishing a third list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Commission Directive 2000/39/EC
Lead dibromide	10031-22-8	TWA	0.15 mg/m ³	Europe. Chemical Agents Directive - Annex I: Binding occupational exposure limit values
	Remarks	Binding		
Lead diiodide	10101-63-0	TWA	0.15 mg/m ³	Europe. Chemical Agents Directive - Annex I: Binding occupational exposure limit values
	Remarks	Binding		

Biological occupational exposure limits

Component	CAS #	Parameters	Value	Biological specimen	Basis
Lead dibromide	10031-22-8	Lead	0.7 mg/l	Blood	Chemical Agents Directive - Annex II: Binding biological limit values
	Remarks	Biological monitoring must include measuring the blood-lead level (PbB) using absorption spectrometry or a method giving equivalent results., Medical surveillance is carried out if: - exposure to a concentration of lead in air is greater than 0,075 mg/m ³ , calculated as a time-weighted average over 40 hours per week, or - a blood-lead level greater than 40 µg Pb/100 ml blood is measured in individual workers., Practical guidelines for biological monitoring and medical surveillance must be developed in accordance with article 12, paragraph 2. These include recommendations of biological indicators (e.g. ALAU, ZPP, ALAD) and biological monitoring strategies.			
Lead diiodide	10101-63-0	Lead	0.7 mg/l	Blood	Chemical Agents Directive - Annex II: Binding biological limit values
	Remarks	Biological monitoring must include measuring the blood-lead level (PbB) using absorption spectrometry or a method giving equivalent results., Medical surveillance is carried out if: - exposure to a concentration of lead in air is greater than 0,075 mg/m ³ , calculated as a time-weighted average over 40 hours per week, or - a blood-lead level greater than 40 µg Pb/100 ml blood is measured in individual workers., Practical guidelines for biological monitoring and medical surveillance must be developed in accordance with article 12, paragraph 2. These include recommendations of biological indicators (e.g. ALAU, ZPP, ALAD) and biological monitoring strategies.			

8.2. Exposure controls

Engineering measures

Handle in accordance with good industrial engineering/laboratory practices for hygiene and safety. Ensure eyewash stations and safety showers are close to the laboratory workstation. Ensure good general ventilation is present when handling the product.

Personal protective equipment

Eyes: Wear safety glasses with side-shields conforming to appropriate government standards such as NOISH (US) or EN166 (EU).

Skin: Handle with appropriate gloves and use proper glove removal technique to avoid skin contact. Dispose of gloves in accordance with applicable laws. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Clothing: Wear complete suit protecting against chemicals; the type of equipment should be appropriate for the concentration and amount of dangerous substance used.

Respirators: Where further protection as a backup to engineering controls are necessary, use type N100 (US) or type P3 (EN 143) full-face particle respirator or those approved under appropriate government standards such as NIOSH (US) or CEN (EU).

General hygiene measures

Wash thoroughly after handling. Wash contaminated clothing before reuse.

9. Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	:	Yellow solution
Odour	:	Amine-like
Odour threshold	:	No data available
Molecular weight	:	n/a
pH	:	No data available
Melting/freezing point	:	- 60 °C (approximate)
Flash point	:	58 °C (approximate)
Evaporation rate	:	No data available
Flammability	:	No data available
Explosive limits	:	No data available
Vapour pressure	:	No data available
Vapour density	:	No data available
Relative density	:	No data available
Water solubility	:	Miscible
Partition coefficient: <i>n</i> -octanol/water	:	No data available
Autoignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity	:	No data available
Explosive properties	:	No data available
Oxidizing properties	:	No data available

9.2. Other safety information

No data available.

10. Stability and reactivity

10.1 Reactivity

No data available.

10.2. Chemical stability

Stable under normal temperatures and pressures. May be sensitive to light.

10.3. Possibility of hazardous reactions

No data available.

10.4. Conditions to avoid

Heat, flames and sparks.

10.5. Incompatible materials

Strong oxidising agents, strong acids.

10.6. Hazardous decomposition products

Not determined. Hazardous polymerisation not determined.

11. Toxicological information

11.1. Information on toxicological effects

Acute toxicity

No data available.

Skin corrosion/irritation

Skin - Human - Mild skin irritation – 24 h.

Serious eye damage/eye irritation

No data available.

Respiratory or skin sensitization

No data available.

Germ cell mutagenicity

No data available.

Carcinogenicity

IARC: 2A - Group 2A: Probably carcinogenic to humans (Lead diiodide/Lead dibromide)

Reproductive toxicity

Possible risk of congenital malformation in the fetus.

Known human reproductive toxicant.

Specific target organ toxicity - single exposure

No data available.

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available.

Potential health effects

Inhalation	Toxic if inhaled. May cause respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	Harmful if absorbed through skin. May cause skin irritation.
Eyes	Cause serious eye irritation.

Signs and Symptoms of Exposure

Lead salts have been reported to cross the placenta and to induce embryo- and feto- mortality. They also have teratogenic effect in some animal species. No teratogenic effects have been reported with exposure to organometallic lead compounds. Adverse effects of lead on human reproduction, embryonic and fetal development, and postnatal (e.g., mental) development have been reported. Excessive exposure can affect blood, nervous, and digestive systems. The synthesis of hemoglobin is inhibited and results in anemia. If left untreated, neuromuscular dysfunction, possible paralysis, and encephalopathy can result. Additional symptoms of overexposure include: joint and muscle pain, weakness of the extensor muscles (frequently the hand and wrist), headache, dizziness, abdominal pain, diarrhea, constipation, nausea, vomiting, blue line on the gums, insomnia, and metallic taste. High body levels produce increased cerebrospinal pressure, brain damage, and stupor leading to coma and often death.

Warning: intolerance for alcohol can occur up to 4 days after dimethylformamide exposure.

N,Ndimethylformamide is considered to be a potent liver toxin., Vomiting, Diarrhoea, Abdominal pain, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. Ecological information

12.1. Toxicity

No data available.

12.2. Persistence and degradability

Not readily biodegradable.

12.3. Bioaccumulative potential

No data available.

12.4. Mobility in soil

No data available.

12.5. Results of PBT and vPvB assessment

No data available.

12.6. Other adverse effects

Very toxic to aquatic life with long lasting effects.

13. Disposal

13.1. Waste treatment methods

Product

Contact a licensed professional waste disposal service to dispose of this solution. Burn in a chemical incinerator equipped with an afterburner and scrubber, but take care in igniting as the material is flammable. Observe all federal, state, and local environmental regulations.

Contaminated packaging

Dispose of as unused product.

14. Transport

14.1. UN number

ADR/RID: 1992

IMDG: 1992

IATA: 1992

14.2. UN proper shipping name

ADR/RID: FLAMMABLE LIQUID, TOXIC, N.O.S. (N,N-dimethylformamide, dimethylsulfoxide, lead diiodide, lead dibromide solution)

IMDG: FLAMMABLE LIQUID, TOXIC, N.O.S. (N,N-dimethylformamide, dimethylsulfoxide, lead diiodide, lead dibromide solution)

IATA: Flammable liquid, toxic, n.o.s. (N,N-dimethylformamide, dimethylsulfoxide, lead diiodide, lead dibromide solution)

14.3. Transport hazard class:

ADR/RID: 3 (6.1)

IMDG: 3 (6.1)

IATA: 3 (6.1)

14.4. Packaging group

ADR/RID: III

IMDG: III

IATA: III

14.5. Environmental hazards:

ADR/RID: Yes

IMDG: Yes

IATA: Yes

15. Regulatory information

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

No data available.

15.2 Chemical Safety Assessment

No data available.

16. Other information

Warranty

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