

## Safety Data Sheet

acc. to OSHA HCS

Printing date 08/04/2022

Reviewed on 08/04/2022

### 1 Identification

- **Product identifier**
- **Trade name:** AG-888 Silver Conductive Ink
- **Application of the substance / the mixture** Functional electronic silver printing ink
- **Details of the supplier of the safety data sheet**
- **Manufacturer/Supplier:**  
 Kayaku Advanced Materials, Inc.  
 200 Flanders Road  
 Westborough, MA 01581  
 Tel: (617) 965-5511  
 Fax: (617) 965-5818
- **Information department:**  
 Product Safety  
 Email: [productsafety@kayakuAM.com](mailto:productsafety@kayakuAM.com)
- **Emergency telephone number:**  
 Kayaku Advanced Materials : 617-965-5511  
 Chemtrec USA Emergency : 800-424-9300  
 Chemtrec International Emergency : 703-527-3887

### 2 Hazard(s) identification

- **Classification of the substance or mixture**



GHS05 Corrosion

Eye Damage 1

H318 Causes serious eye damage.



GHS09 Environment

Aquatic Acute 1

H400 Very toxic to aquatic life.

Aquatic Chronic 1

H410 Very toxic to aquatic life with long lasting effects.



GHS07

Acute Toxicity - Inhalation 4

H332 Harmful if inhaled.

Specific Target Organ Toxicity - Single Exposure 3 H336 May cause drowsiness or dizziness.

- **Label elements**
- **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
- **Hazard pictograms**



GHS05



GHS07



GHS09

- **Signal word** Danger

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· **Hazard-determining components of labeling:**

gamma-Butyrolactone

· **Hazard statements**

H332 Harmful if inhaled.

H318 Causes serious eye damage.

H336 May cause drowsiness or dizziness.

H400 Very toxic to aquatic life.

H410 Very toxic to aquatic life with long lasting effects.

· **Precautionary statements**

P261 Avoid breathing dust/fume/gas/mist/vapors/spray

P273 Avoid release to the environment.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P301+P310 If swallowed: Immediately call a poison center/doctor.

P302+P352 If on skin: Wash with plenty of soap and water.

P304+P341 If inhaled: If breathing is difficult, remove person to fresh air and keep comfortable for breathing.

P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P333+P313 If skin irritation or rash occurs: Get medical advice/attention.

P337+P313 If eye irritation persists: Get medical advice/attention.

P403+P233 Store in a well-ventilated place. Keep container tightly closed.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3

Fire = 1

Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**



Health = \*3

Fire = 1

Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

### 3 Composition/information on ingredients

· **Chemical characterization: Mixtures**

· **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Dangerous components:**

7440-22-4	Silver	60-80%
	⚠ Aquatic Acute 1, H400; Aquatic Chronic 1, H410	
96-48-0	gamma-Butyrolactone	25-50%
	⚠ Eye Damage 1, H318; ⚠ Acute Toxicity - Oral 4, H302; Specific Target Organ Toxicity - Single Exposure 3, H336	

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**Additional Components:**

Polyurethane polymer

5-15%

### 4 First-aid measures

**Description of first aid measures**

- **General information:** Immediately remove any clothing soiled by the product.
- **After inhalation:** Supply fresh air; consult doctor in case of complaints.
- **After skin contact:** Generally the product does not irritate the skin.
- **After eye contact:**  
Wash eyes immediately with a large amount of water or normal saline, occasionally lifting upper and lower eye lids until no evidence of chemical remains (about 20 minutes). Remove contact lenses if present and easy to remove. Seek immediate medical attention.
- **After swallowing:** Do not induce vomiting; immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed** No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed** Treat symptomatically.

### 5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**  
Alcohol resistant foam  
Fire-extinguishing powder  
ABC powder
- **For safety reasons unsuitable extinguishing agents:** Water with full jet
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Wear SCBA.

### 6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**  
Ensure adequate ventilation  
Wear protective equipment. Keep unprotected persons away.  
Keep away from ignition sources
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**  
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).  
Ensure adequate ventilation.
- **Reference to other sections**  
See Section 7 for information on safe handling.  
See Section 8 for information on personal protection equipment.  
See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**

**PAC-I:**

7440-22-4 Silver

 0.3 mg/m<sup>3</sup>

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96-48-0	gamma-Butyrolactone	3.6 mg/m <sup>3</sup>
<b>· PAC-2:</b>		
7440-22-4	Silver	170 mg/m <sup>3</sup>
96-48-0	gamma-Butyrolactone	39 mg/m <sup>3</sup>
<b>· PAC-3:</b>		
7440-22-4	Silver	990 mg/m <sup>3</sup>
96-48-0	gamma-Butyrolactone	310 mg/m <sup>3</sup>

### 7 Handling and storage

- **Handling:**
- **Precautions for safe handling**  
 Ensure good ventilation/exhaust at the workplace.  
 Prevent formation of aerosols.
- **Information about protection against explosions and fires:**  
 Keep ignition sources away - Do not smoke.  
 Protect against electrostatic charges.
- **Conditions for safe storage, including any incompatibilities**
- **Storage:**
- **Requirements to be met by storerooms and containers:** No special requirements.
- **Information about storage in one common storage facility:**  
 Do not store together with alkalis (caustic solutions).  
 Do not store together with oxidizing and acidic materials.
- **Further information about storage conditions:**  
 Keep container well-sealed in cool, dry location.  
 Protect from heat and direct sunlight.  
 Store receptacle in a well ventilated area.
- **Specific end use(s)** No further relevant information available.

### 8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see item 7.
- **Control parameters**
- **Components with limit values that require monitoring at the workplace:**  
 The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
- **Additional information:** The lists that were valid during the creation were used as basis.
- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**  
 Keep away from food and beverages.  
 Immediately remove all soiled and contaminated clothing.  
 Wash hands before breaks and at the end of work.  
 Avoid contact with the eyes.  
 Avoid contact with the eyes and skin.
- **Respiratory equipment:**  
 In case of low exposure, use cartridge respirator. In case of intensive or longer exposure, use SCBA.

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**Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

 · **Material of gloves** Nitrile rubber, NBR

 · **Penetration time of glove material** Contact glove manufacture for break-through time.

**Eye protection:**


Tightly sealed goggles

### 9 Physical and chemical properties

**Information on basic physical and chemical properties**
**General Information**
**Appearance:**

<b>Form:</b>	Liquid
<b>Color:</b>	Silver-colored
<b>Odor:</b>	Sweet
<b>Odor threshold:</b>	Not determined.

 · **pH-value:** Not determined.

**Change in condition**

<b>Melting point/Melting range:</b>	Undetermined.
<b>Boiling point/Boiling range:</b>	205 °C (401 °F)

 · **Flash point:** 100 °C (212 °F)

 · **Flammability (solid, gaseous):** Not applicable.

 · **Ignition temperature:** 445 °C (833 °F)

 · **Decomposition temperature:** Not determined.

 · **Auto igniting:** Product is not selfigniting.

 · **Danger of explosion:** Product does not present an explosion hazard.

**Explosion limits:**

<b>Lower:</b>	2.7 Vol %
<b>Upper:</b>	15.6 Vol %

 · **Vapor pressure at 20 °C (68 °F):** > 1 hPa (> 0.8 mm Hg)

 · **Density at 20 °C (68 °F):** 6.82876 g/cm<sup>3</sup> (56.986 lbs/gal)

 · **Relative density** Not determined.

 · **Vapor density** Not determined.

 · **Evaporation rate** 1.6-2.3 (BuAc=1)

**Solubility in / Miscibility with**
**Water:** Water miscible No

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- |   |                 |
|---|-----------------|
| · <b>Partition coefficient (n-octanol/water):</b> Not determined.     |                 |
| · <b>Viscosity:</b>   |                 |
| Dynamic:  | Not determined. |
| Kinematic:  | Not determined. |
| · <b>Solvent content:</b>   |                 |
| Organic solvents:   | 25-50 %         |
| VOC content:  | 25-50 %         |
| Solids content:   | 66-70 %         |
| · <b>Other information</b> No further relevant information available. |                 |

### 10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability** Stable
- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid**  
 Heat, flames and sparks. Extremes of temperature and direct sunlight.  
 Exposure to strong acids and oxidizing agents.
- **Incompatible materials:** Strong Oxidizing Agents, Strong Acids, Strong Bases
- **Hazardous decomposition products:** Carbon monoxide and carbon dioxide

### 11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**

 · **LD/LC50 values that are relevant for classification:**

#### 96-48-0 gamma-Butyrolactone

Oral	LD50	1540 mg/kg (Rat)
Dermal	LD50	5000 mg/kg (gui)
Inhalative	LC50/4 h	>5.1 mg/l (Rat)

- **Primary irritant effect:**
- **on the skin:** No irritant effect.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**  
 The product shows the following dangers according to internally approved calculation methods for preparations:  
 Harmful  
 Irritant

- **Carcinogenic categories**

 · **IARC (International Agency for Research on Cancer)**

96-48-0 gamma-Butyrolactone	3
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**· NTP (National Toxicology Program)**

None of the ingredients are listed.

**· OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients are listed.

### 12 Ecological information

**· Toxicity**
**· Aquatic toxicity:**
**96-48-0 gamma-Butyrolactone**

LC50/96 h &gt; 220 - &lt; 460 mg/l (golden orfe)

EC50/48 h &gt; 500 mg/l (daphnia magna)

EC50/72 h 360 mg/l (green algae)

EC50/17 h &gt; 10000 mg/l (bacterium)

**7440-22-4 Silver**

LC50/96 h (static) 0.0062 mg/l (Lepomis macrochirus (Bluegill))

0.00155-0.00293 mg/l (Pimephales promelas)

**· Persistence and degradability** No further relevant information available.

**· Behavior in environmental systems:**
**· Bioaccumulative potential** No further relevant information available.

**· Mobility in soil** No further relevant information available.

**· Additional ecological information:**
**· General notes:**

Water hazard class 2 (Self-assessment): hazardous for water

Do not allow product to reach ground water, water course or sewage system.

Danger to drinking water if even small quantities leak into the ground.

**· Results of PBT and vPvB assessment**
**· PBT:** Not applicable.

**· vPvB:** Not applicable.

**· Other adverse effects** No further relevant information available.

### 13 Disposal considerations

**· Waste treatment methods**
**· Recommendation:**

Must not be disposed of as regular garbage/trash. Do not allow product to reach sewage system.

Disposal must be made in accordance with Federal, State, and Local regulations.

**· Uncleaned packagings:**
**· Recommendation:** Disposal must be made in accordance with Federal, State, and Local regulations.

### 14 Transport information

**· UN-Number**
**· DOT, ADR, IMDG, IATA**

UN3082

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<ul style="list-style-type: none"> <li>· <b>UN proper shipping name</b></li> <li>· <b>DOT, ADR</b></li> <li>· <b>IMDG</b></li> <li>· <b>IATA</b></li> </ul>	Environmentally hazardous substances, liquid, n.o.s. (Silver) ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Silver), MARINE POLLUTANT ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Silver)
<ul style="list-style-type: none"> <li>· <b>Transport hazard class(es)</b></li> <li>· <b>DOT, ADR, IMDG, IATA</b></li> </ul>  <ul style="list-style-type: none"> <li>· <b>Class</b></li> <li>· <b>Label</b></li> </ul>	9 Miscellaneous dangerous substances and articles 9
<ul style="list-style-type: none"> <li>· <b>Packing group</b></li> <li>· <b>DOT, ADR, IMDG, IATA</b></li> </ul>	III
<ul style="list-style-type: none"> <li>· <b>Environmental hazards:</b></li> <li>· <b>Marine pollutant:</b></li> </ul>	Product contains environmentally hazardous substances: Silver Yes (DOT)
<ul style="list-style-type: none"> <li>· <b>Special precautions for user</b></li> <li>· <b>Hazard identification number (Kemler code):</b></li> <li>· <b>EMS Number:</b></li> <li>· <b>Stowage Category</b></li> </ul>	Warning: Miscellaneous dangerous substances and articles 90 F-A,S-F A
<ul style="list-style-type: none"> <li>· <b>Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code</b></li> </ul>	Not applicable.
<ul style="list-style-type: none"> <li>· <b>Transport/Additional information:</b></li> <li>· <b>DOT</b></li> <li>· <b>Quantity limitations</b></li> </ul>	On passenger aircraft/rail: No limit On cargo aircraft only: No limit
<ul style="list-style-type: none"> <li>· <b>ADR</b></li> <li>· <b>Excepted quantities (EQ)</b></li> </ul>	Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
<ul style="list-style-type: none"> <li>· <b>IMDG</b></li> <li>· <b>Limited quantities (LQ)</b></li> <li>· <b>Excepted quantities (EQ)</b></li> </ul>	5L Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
<ul style="list-style-type: none"> <li>· <b>UN "Model Regulation":</b></li> </ul>	UN 3082 ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (SILVER), 9, III

US

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### 15 Regulatory information

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

· Sara

· Section 355 (extremely hazardous substances):

None of the ingredients are listed.

· Section 313 (Specific toxic chemical listings):

7440-22-4 Silver

· TSCA (Toxic Substances Control Act): All ingredients are listed or comply with TSCA regulations.

· Proposition 65

· Chemicals known to cause cancer:

None of the ingredients are listed.

· Chemicals known to cause reproductive toxicity for females:

None of the ingredients are listed.

· Chemicals known to cause reproductive toxicity for males:

None of the ingredients are listed.

· Chemicals known to cause developmental toxicity:

None of the ingredients are listed.

· Carcinogenic categories

· EPA (Environmental Protection Agency)

7440-22-4 Silver

D

· TLV (Threshold Limit Value)

None of the ingredients are listed.

· NIOSH-Ca (National Institute for Occupational Safety and Health)

None of the ingredients are listed.

· Massachusetts State Right To Know List

7440-22-4 Silver

· New Jersey State Right To Know List

7440-22-4 Silver

96-48-0 gamma-Butyrolactone

· Pennsylvania Hazardous Substances List

7440-22-4 Silver

96-48-0 gamma-Butyrolactone

· California SCAQMD Rule 443.1 VOC's: No information available.

· GHS label elements The product is classified and labeled according to the Globally Harmonized System (GHS).

· Hazard pictograms



GHS05

GHS07

GHS09

· Signal word Danger

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**· Hazard-determining components of labeling:***gamma-Butyrolactone***· Hazard statements***H332 Harmful if inhaled.**H318 Causes serious eye damage.**H336 May cause drowsiness or dizziness.**H400 Very toxic to aquatic life.**H410 Very toxic to aquatic life with long lasting effects.***· Precautionary statements***P261 Avoid breathing dust/fume/gas/mist/vapors/spray**P273 Avoid release to the environment.**P280 Wear protective gloves/protective clothing/eye protection/face protection.**P301+P310 If swallowed: Immediately call a poison center/doctor.**P302+P352 If on skin: Wash with plenty of soap and water.**P304+P341 If inhaled: If breathing is difficult, remove person to fresh air and keep comfortable for breathing.**P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.**P333+P313 If skin irritation or rash occurs: Get medical advice/attention.**P337+P313 If eye irritation persists: Get medical advice/attention.**P403+P233 Store in a well-ventilated place. Keep container tightly closed.**P501 Dispose of contents/container in accordance with local/regional/national/international regulations.***· National regulations:****· Other regulations, limitations and prohibitive regulations***RoHS (EU)2015/863 along with EU Directive 2002/95/EC – Waste from Electrical and Electronic Equipment (WEEE):**Applied Ink Solutions products do not exceed the amount of allowable levels concerning: Cadmium (Cd); Mercury (Hg); Lead (Pb); Hexavalent chromium (Cr6+); Polybrominated biphenyls (PBB); Polybrominated diphenyl ethers (PBDE); Bis(2-Ethylhexyl) phthalate (DEHP); Benzyl butyl phthalate (BBP); Dibutyl phthalate (DBP); Diisobutyl phthalate (DIBP).**Applied Ink Solutions has confirmed with our precious metal suppliers that they do not use conflict minerals, as outlined in the Dodd-Frank Wall Street Reform and Consumer Protection Act in Title XV, Section 1502.**Registration, Evaluation and Authorization of Chemicals (REACH) & Substances of Very High Concern (SVHC):**This product does not contain substances on the SVHC list.***· Chemical safety assessment: A Chemical Safety Assessment has not been carried out.****16 Other information***This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.***· Department issuing SDS: Product safety department****· Contact:** Tom Cole, EHS Manager (tcole@kayakuAM.com)**· Revision History:***The manufacturer's information in Section 1, the product hazard information in Section 2 and the component hazard information in Section 3 have been updated.***· Date of preparation / last revision** 08/04/2022

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**Abbreviations and acronyms:**

ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)  
IMDG: International Maritime Code for Dangerous Goods  
DOT: US Department of Transportation  
IATA: International Air Transport Association  
EINECS: European Inventory of Existing Commercial Chemical Substances  
ELINCS: European List of Notified Chemical Substances  
CAS: Chemical Abstracts Service (division of the American Chemical Society)  
NFPA: National Fire Protection Association (USA)  
HMIS: Hazardous Materials Identification System (USA)  
VOC: Volatile Organic Compounds (USA, EU)  
LC50: Lethal concentration, 50 percent  
LD50: Lethal dose, 50 percent  
PBT: Persistent, Bioaccumulative and Toxic  
vPvB: very Persistent and very Bioaccumulative  
NIOSH: National Institute for Occupational Safety  
OSHA: Occupational Safety & Health  
TLV: Threshold Limit Value  
PEL: Permissible Exposure Limit  
REL: Recommended Exposure Limit  
Acute Toxicity - Oral 4: Acute toxicity – Category 4  
Eye Damage 1: Serious eye damage/eye irritation – Category 1  
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3  
Aquatic Acute 1: Hazardous to the aquatic environment - acute aquatic hazard – Category 1  
Aquatic Chronic 1: Hazardous to the aquatic environment - long-term aquatic hazard – Category 1

US