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

1.1. Product identifier

Trade Name: Silver Ink AG-SC1

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses: Conductive silver ink used for flexible printed electronics purposes.

Uses advised against: Do not use for any other purpose.

1.3. Details of the supplier of the safety data sheet

YD Ynvisible, S.A.
Rua Quinta do Bom Retiro, 12C, 2820-690 Charneca de Caparica, Portugal
Telephone: +351 211 308 817
Email: info@ynvisible.com
Web: www.ynvisible.com

1.4. Emergency telephone number

Portugal: Centro de Informação Anti-Venenos: +351 800 250 250

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) no. 1272/2008 [CLP/GHS]:

Skin Corrosion/Irritation Category 2, H315
Eye Irritation Category 2, H319
Acute Aquatic Hazard Category 1, H400
Chronic Aquatic Hazard Category 1, H410

For abbreviations, refer to Section 16.

2.2. Label elements

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]:

Hazard Pictogram:

Signal Word:

Warning

Hazard Statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary Statements:

General:

P101 If medical advice is needed, have product container or label at hand.
P102 Keep out of reach of children.

Prevention:

P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Continued on next page

Response:

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

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

P391 Collect spillage.

P302+P352 IF ON SKIN: Wash with plenty of water and soap.

P332+P313 If skin irritation occurs: Get medical advice/attention.

P362+P364 Take off contaminated clothing and wash it before reuse.

Disposal:

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

Additional Labelling:

EUH208 Contains hydroquinone. May produce an allergic reaction.

2.3. Other hazards

Ingestion may produce health damage. Possible skin sensitizer.

hydroquinone: Listed in the Europe Regulation (EC) No 1907/2006 - Annex XVII (Restrictions may apply).

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Description of the mixture:

Mixture used as conductive ink in electrochromic devices.

Chemical nature:

Organic and inorganic mixture.

Hazardous ingredients:

Chemical Name	CAS-No.	EC-No.	Index No.	Concentration range (% by wt.)	CLP (Reg. 1272/2008) Classification
silver flake	7440-22-4	231-131-3	-	60 - 80	Aquatic Chronic 1 H410 Aquatic Acute 1 H400
DE acetate	112-15-2	203-940-1	-	20 - 40	Skin Irrit. 2 H315
hydroquinone	123-31-9	204-617-8	604-005-00-4	<1	Carc. 2 H351 Muta. 2 H341 Aquatic Acute 1 H400 Eye Dam. 1 H318 Skin Sens. 1 H317 Acute Tox. (Oral) 4 H302

For full text of H statements and abbreviations, see Section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General notes:

Consult a physician. Show this safety data sheet to the doctor in attendance

Following inhalation:

Remove to fresh air and keep at rest in half-upright position. Seek medical attention if symptoms arise.

Following skin contact:

Remove all contaminated clothing including footwear. Wash skin and hair with soap and rinse with plenty of water. Seek medical attention if irritation arises. Wash clothes before re-use.

Following eye contact:

Immediately rinse with running water. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. Seek medical attention without delay; if pain persists or recurs seek medical attention. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Continued on next page

Following ingestion:

Offer the casualty 1 or 2 glasses of water to drink. Never give anything by mouth to an unconscious person. First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Self-protection of first aider:

Personal protective equipment for first aid responders is recommended according to potential for exposure (refer to Section 8).

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

Following inhalation:

The material is not thought to produce adverse health effects or irritation of the respiratory tract.

Following skin contact:

May cause inflammation of the skin on contact in some persons and may accentuate any pre-existing dermatitis condition.

Following eye contact:

May cause irritation and damage.

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

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:

Foam, dry chemical powder, BCF (Bromochlorodifluoromethane) (where regulations permit).

5.2. Special hazards arising from the substance or mixture

Fire incompatibility: none known.

5.3. Advice for firefighters

In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

5.4. Additional information

Provide storage and work areas with suitable fire extinguishers.

Call the Fire Brigade at once to deal with all fires involving chemicals unless the fire is small and immediately controllable. If without risk, remove intact containers from exposure to fire. Contain fire-fighting water, bunding if necessary with sand or earth. Do not allow contamination of public drains or surface or ground waters. Dispose of fire debris and contaminated water by containing and soaking up the spillage with inert and adsorbent material before disposing of safely and legally, for example through a licensed waste disposal contractor.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

See section 8.

6.2. Environmental precautions

See section 12.

6.3. Methods and material for containment and cleaning up

For containment:

Clean up spills immediately and place in a compatible disposal container. Contain spill by diking with earth, sand or absorbent material and place into a compatible marked disposal container. Avoid breathing vapours and contact with skin and eyes.

Control personal contact with the substance, by using protective equipment.

For cleaning up:

Soak up wash liquid with additional absorbent material and place into a compatible marked disposal container. Seal container and arrange for disposal.

6.4. Reference to other sections

Refer to Section 8 for personal protective equipment and to Section 13 for disposal instructions.

Continued on next page

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid all contact by mouth, with eyes and skin. DO NOT allow clothing wet with material to stay in contact with skin. Avoid inhalation of mist or vapour. Wear personal protective equipment as specified in Section 8. Provide suitable ventilation in the areas where the product is stored and used.

7.2. Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry, cool, and well-ventilated place. Store in original containers. Keep containers securely sealed. Suitable container: Metal can or drum. Packaging as recommended by manufacturer. Check all containers are clearly labelled and free from leaks. Storage incompatibility: None known.

7.3. Specific end use(s)

Conductive silver ink used for flexible printed electronics purposes.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Not available for the mixture.

Components:

Hydroquinone: TWA 2 mg/m^3

Silver flake: 0,1 mg/m^3

Source: Portugal Occupational exposure limits to chemical agents

8.2. Exposure controls

Appropriate engineering controls:

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are process controls which involve changing the way a job activity or process is done to reduce the risk.

Personal protection equipment:

Eye and face protection:

Safety glasses with side shields. Chemical goggles. Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.

Skin protection:

Hand protection:

Wear chemical protective gloves, e.g. PVC. Wear safety footwear or safety gumboots, e.g. Rubber. The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.

Body protection:

Overalls. P.V.C. apron.

Environmental exposure controls:

Implement all applicable local and community environmental protection legislation. Refer to Section 15. Use appropriate containment to avoid environmental contamination. Do not empty into drains. Do not contaminate water with the product or used container. Refer to Section 12.

Continued on next page

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

a) Appearance: Colour:	Silver Silver
b) Odour:	Not Available
c) Odour threshold:	Not Available
d) pH:	Not Available
e) Melting point/freezing point:	Not Available
f) Initial boiling point and boiling range:	Not Available
g) Flash point:	>100 °C
h) Evaporation rate:	Not Available
i) Flammability (solid, gas):	Not applicable
j) Upper/lower flammability or explosive limits:	Not Available
k) Vapour pressure:	Not Available
l) Vapour density:	Not Available
m) Density:	2,56 g/cm^3
n) Solubility(ies) Solubility (water):	Not determined Immiscible
o) Partition coefficient: n-octanol/water:	Not Available
p) Auto-ignition temperature:	Not Available
q) Decomposition temperature:	Not Available
r) Viscosity:	Not available
s) Explosive properties:	Not Available
t) Oxidising properties:	Not Available

9.2. Other information

Not available.

SECTION 10: Stability and reactivity

10.1. Reactivity

See section 7.2

10.2. Chemical stability

Unstable in the presence of incompatible materials. Product is considered stable.
Hazardous polymerisation will not occur.

10.3. Possibility of hazardous reactions

See section 7.2.

10.4. Conditions to avoid

See section 7.2.

10.5. Incompatible materials

See section 7.2.

10.6. Hazardous decomposition products

See section 5.3.

Continued on next page

SECTION 11: Toxicological information

11.1. Information on toxicological effects

a) acute toxicity	Data either not available or does not fill the criteria for classification. Components: Hydroquinone Oral (rat) LD50: 302 mg/kg (1) Dermal (rabbit) LD50: >2.000 mg/kg (2) Silver flake Oral (rat) LD50: >2.000 mg/kg (1) Dermal (rat) LD50: >2.000 mg/kg (2) DE acetate Oral (rat) LD50: 11.000 mg/kg (1) Dermal (rabbit) LD50: >15.266 mg/kg (1) (1) Value obtained from manufacturer's SDS (2) Value obtained from Europe ECHA Registered Substances - Acute toxicity
b) skin corrosion/irritation	Components: Hydroquinone Skin (human): 2% - mild Skin (human): 5% - SEVERE The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration. Animal testing shows that hydroquinone is rapidly and extensively absorbed from the gut and lung. Absorption via the skin is slow, but may be accelerated with alcohols. Hydroquinone distributes rapidly and widely among tissues.
c) serious eye damage/irritation	Data either not available or does not fill the criteria for classification.
d) respiratory or skin sensitisation	Data either not available or does not fill the criteria for classification.
e) germ cell mutagenicity	Data either not available or does not fill the criteria for classification.
f) carcinogenicity	Data either not available or does not fill the criteria for classification. Components: Hydroquinone The substance is classified by IARC as Group 3: NOT classifiable as to its carcinogenicity to humans. Evidence of carcinogenicity may be inadequate or limited in animal testing.
g) reproductive toxicity	Data either not available or does not fill the criteria for classification.
h) STOT-single exposure	Data either not available or does not fill the criteria for classification.
i) STOT-repeated exposure	Data either not available or does not fill the criteria for classification.
j) aspiration hazard	Data either not available or does not fill the criteria for classification.

Inhaled

The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.

Ingestion

The material has not been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.

Swallowing 10 millilitres of isopropanol may cause serious injury; 100 millilitres may be fatal if not properly treated. The adult single lethal dose is approximately 250 millilitres. Isopropanol is twice as poisonous as ethanol, and the effects caused are similar, except that isopropanol does not cause an initial feeling of well-being.

Continued on next page

Skin Contact

This material can cause inflammation of the skin on contact in some persons. The material may accentuate any pre-existing dermatitis condition. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.

Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

Eye

This material can cause eye irritation and damage in some persons.

Chronic

There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment. Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population.

SECTION 12: Ecological information

12.1. Toxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Do not allow product to come in contact with surface waters or to intertidal areas below the mean high-water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites. Do not discharge into sewer or waterways.

Components:

DE acetate:

Endpoint	Test duration (hr)	Species	Value	Source
LC50	96	Fish	>5 - 13 mg/L	(1)
EC50	48	Crustacea	>100 mg/L	(1)
EC50	72	Algae or aq. plants	>1 mg/L	(1)
NOEC	72	Algae or aq. plants	1 mg/L	(1)

Hydroquinone:

Endpoint	Test duration (hr)	Species	Value	Source
LC50	96	Fish	0,044 mg/L	(2)
EC50	48	Crustacea	0,061 mg/L	(1)
EC50	96	Algae or aq. plants	0,008 mg/L	(3)
BCF	24	Algae or aq. plants	0,05 mg/L	(2)
NOEC	72	Algae or aq. plants	0,002 mg/L	(1)

Silver flake:

Endpoint	Test duration (hr)	Species	Value	Source
LC50	96	Fish	>0,001 - 0,93 mg/L	(1)
EC50	48	Crustacea	0,00024 mg/L	(2)
EC50	96	Algae or aq. plants	0,00001 mg/L	(1)
BCF	336	Crustacea	0,02 mg/L	(2)
NOEC	72	Algae or aq. plants	0,000003 mg/L	(1)

(1) Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity

(2) US EPA, Ecotox database - Aquatic Toxicity Data

(3) EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated)

Continued on next page

12.2. Persistence and degradability

Components:

DE acetate: LOW in Water/Soil and Air

Hydroquinone: LOW in Water/Soil and Air

12.3. Bioaccumulative potential

Components:

DE acetate: LOW (LogKOW = 0,3154)

Hydroquinone: LOW (BCF = 65)

12.4. Mobility in soil

Components:

DE acetate: LOW (KOC = 10)

Hydroquinone: LOW (KOC = 434)

12.5. Results of PBT and vPvB assessment

Relevant available data: not applicable

PBT Criteria fulfilled: not applicable

12.6. Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Containers may still present a chemical hazard/ danger when empty.

Return to supplier for reuse/ recycling if possible.

Otherwise: If container cannot be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

Do not allow wash water from cleaning or process equipment to enter drains.

It may be necessary to collect all wash water for treatment before disposal.

In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.

Recycle wherever possible or consult manufacturer for recycling options.

Consult State Land Waste Management Authority for disposal.

Bury residue in an authorised landfill.

SECTION 14: Transport information

14.1. UN number

3082

14.2. UN proper shipping name

ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (contains silver flake)

14.3. Transport hazard class(es)

9

14.4. Packing group

III

Continued on next page

14.5. Environmental hazards

Land transport (ADR)

Environmental hazard: Environmentally hazardous
Hazard identification (Kemler): 90
Classification code: M6
Hazard Label: 9
Special provisions: 274 335 375 601
Limited quantity: 5 L

Air transport (ICAO-IATA / DGR)

Environmental hazard: Environmentally hazardous
ERG Code: 9L
Special provisions: A97 A158 A197
Cargo Only Packing Instructions: 964
Cargo Only Maximum Qty / Pack: 450 L
Passenger and Cargo Packing Instructions: 964
Passenger and Cargo Maximum Qty / Pack: 450L
Passenger and Cargo Limited Quantity Packing Instructions: Y964
Passenger and Cargo Limited Maximum Qty / Pack: 30 kg G

Sea transport (IMDG-Code / GGVSee)

Environmental hazard: Marine Pollutant
EMS Number: F-A, S-F
Special provisions: 274 335 969
Limited Quantities: 5 L

Inland waterways transport (ADN)

Environmental hazard: Environmentally hazardous
Classification code: M6
Special provisions: 274; 335; 375; 601
Limited quantity; 5 L
Equipment required: PP
Fire cones number: 0

14.6. Special precautions for user

None known.

SECTION 15: Regulatory information

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

DE acetate (112-15-2) is found on the following regulatory lists:

- Europe EC Inventory
- Europe ECHA Registered Substances - Classification and Labelling - DSD-DPD
- European Chemical Agency (ECHA) Classification & Labelling Inventory - Chemwatch Harmonised classification
- European Customs Inventory of Chemical Substances ECICS (English)
- European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)
- GESAMP/EHS Composite List - GESAMP Hazard Profiles
- IMO IBC Code Chapter 17: Summary of minimum requirements
- IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk

Continued on next page

Hydroquinone (123-31-9) is found on the following regulatory lists:

- ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
- EU European Chemicals Agency (ECHA) Community Rolling Action Plan (CoRAP) List of Substances
- EU REACH Regulation (EC) No 1907/2006 - Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles
- Europe EC Inventory
- Europe ECHA Registered Substances - Classification and Labelling - DSD-DPD
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2017, English)
- European Chemical Agency (ECHA) Classification & Labelling Inventory - Chemwatch Harmonised classification
- European Customs Inventory of Chemical Substances ECICS (English)
- European Trade Union Confederation (ETUC) Priority List for REACH Authorisation
- European Union - European Inventory of Existing Commercial Chemical Substances (EINECS) (English)
- European Union (EU) Annex I to Directive 67/548/EEC on Classification and Labelling of Dangerous Substances - updated by ATP: 31
- European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI
- European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI - Chemwatch Standard Format
- European Union (EU) Transport of Dangerous Goods by Road - Dangerous Goods List (English)
- International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
- International Air Transport Association (IATA) Dangerous Goods Regulations
- International Maritime Dangerous Goods Requirements (IMDG Code)
- Portugal Occupational exposure limits to chemical agents (Portuguese)
- Regulations concerning the International Carriage of Dangerous Goods by Rail - Table A: Dangerous Goods List - RID 2019 (English)
- United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)

silver flake (7440-22-4) is found on the following regulatory lists:

- EU European Chemicals Agency (ECHA) Community Rolling Action Plan (CoRAP) List of Substances
- Europe EC Inventory
- Europe ECHA Registered Substances - Classification and Labelling - DSD-DPD
- European Chemical Agency (ECHA) Classification & Labelling Inventory - Chemwatch Harmonised classification
- European Customs Inventory of Chemical Substances ECICS (English)
- European Union - European Inventory of Existing Commercial Chemical Substances (EINECS) (English)
- International WHO List of Proposed Occupational Exposure Limit (OEL) Values for Manufactured Nanomaterials (MNMS)
- Portugal Occupational exposure limits to chemical agents (Portuguese)

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable:

- Directives 98/24/EC, - 92/85/EEC, - 94/33/EC, - 2008/98/EC, - 2010/75/EU; Commission Regulation (EU) 2015/830; Regulation (EC) No 1272/2008 as updated through ATPs.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

Continued on next page

SECTION 16: Other information

a) Indication of changes:

This is the 2nd version of this safety data sheet issued in accordance with Commission Regulation (EC) 453/2010 (REACH regulation for safety data sheets) and Regulation EC 1272/2008 (CLP regulation) and amending Regulation (EC) No. 2015/830

b) Abbreviations and acronyms:

Acute Tox.	Acute toxicity
BCF	Bioconcentration Factor
Carc.	Carcinogenicity
Eye dam.	Serious Eye Damage
IARC	International Agency for Research on Cancer
Kow	n-Octanol/Water Partition Coefficient
Muta.	Germ cell mutagenicity
PBT	Persistent, Bioaccumulative and Toxic
Skin Irrit.	Skin irritation
Skin Sens.	Skin sensitization
TWA	Time Weighted Average
vPvB	very Persistent and very Bioaccumulative

c) Key literature references and sources for data:

Individual component safety data sheets.

ECHA Guidance on the compilation of safety data sheets (Version 1.1, December 2011).

Regulation (EC) No. 2015/830 on the compilation of safety data sheets.

d) Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]

Classification derived on the basis of mixture components.

e) Relevant R-phrases, H-statements and precautionary statements not written out in full under Sections 2 to 15:

H302 Harmful if swallowed.

H315 Causes skin irritation.

H317 May cause an allergic skin reaction.

H318 Causes serious eye damage.

H341 Suspected of causing genetic defects.

H351 Suspected of causing cancer.

H400 Very toxic to aquatic life.

H410 Very toxic to aquatic life with long lasting effects.

f) Training advice:

General occupational hygiene training recommended.

g) Further information:

The information and recommendations in this publication are, to the best of our knowledge, information and belief, accurate at the date of publication. Nothing herein is to be construed as a warranty, expressed or implied. In all cases it is the responsibility of the user to determine the applicability of such information or the suitability of any products for their own particular purpose. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.