

Silver

Date of issue: 01.03.2010

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SECTION 1. Identification of the substance/mixture and of the company/undertaking**1.1 Product identifier:****Name:** silver**Trade name:** electrolytic silver**Synonyms:** electrolytic silver in form of ingots, granules, silver $\geq 99,9\%$ Ag in massive form (the particle size $>1\text{mm}$) – not classified**IUPAC name:** silver**REACH registration No.:** 01-2119555669-21-0029**UN No.:** -**CAS No.:** 7440-22-4**WE No:** 231-131-3**Index number:** -**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses: production of electrolytic silver; refining and recovery of metallic silver; production of alloys with other metals; production of the batteries; used in the electronics industry, electrical; application in electroplating and electroplating, production of material contact; manufacture of silver compounds and silver mixtures; production of catalysts and consumables; welding in industry; professional use of metallic silver alloys and products containing silver.

Uses advised against: not known

1.3 Details of the supplier of the material safety data sheet:

Producer identification: KGHM Polska Miedź S.A.
"Głogów" Copper Smelter & Refinery
ul. Żukowicka 1
67-200 Głogów

Person responsible for preparing the MSDS: Agnieszka Piechota, phone No.: (+48 76) 76) 747 71 76, e-mail: a.piechota@kghm.pl

1.4. Emergency telephone number

Manufacturer (Poland): (48 76) 747 65 001 – available 24/7

Fire Department: 998 – available 24/7

General Emergency: 112 – available 24/7

Phone number where can get more information:

Head of Precious Metals Department: (+48 76) 747 63 88

SECTION 2. Hazards identification**2.1. Classification of the substance or mixture:**Classification according to Regulation No. 1272/2008 (CLP):

Not classified

Classification according to Directive 67/548/EWG:

Not classified

2.2. Label elements:

None

2.3 Other hazards:

Not known.

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SECTION 3. Composition/information on ingredients**3.1. Substances**

a) according to the Regulation No. 1272/2008 (CLP)

No.	Substance name	CAS No.	WE No.	Percentage content [mass fraction]	Symbols	H statements
1.	Silver: - in massive form (> 1mm)	7440-22-4	231-131-3	min. 99,99	-	-

b) according to Directive No. 67/548/EWG

No.	Substance name	CAS No.	WE No.	Percentage content [mass fraction]	Symbols	R statements
1.	Silver: - in massive form (> 1mm)	7440-22-4	231-131-3	min. 99,99	-	-

3.2. Mixtures

n/a

SECTION 4. First Aid measures**4.1 Description of first aid measures:**

Silver in forms of granules and ingots is not hazardous. However, during production and some uses, the hazardous respirable silver-bearing particles may occur/be formed. This section considers the potential hazards caused by the vapours and dust containing silver associated with the production and processing of electrolytic silver

Following inhalation: Take the victim out of the place of exposure. Provide calmness in any position. Protect against loss of body heat. If the victim not breathing, provide artificial respiration using respirator (do not use mouth-to-mouth method). Necessary medical assistance.

Following skin contact: Remove contaminated clothing. Immediately clean contaminated skin with a lot of running water at room temperature. In case of skin changes, seek dermatologist attention.

Following eye contact: Immediately rinse with a lot of cool, running water, for about 15 minutes. Avoid intensive water jet because conjunctiva may become mechanically damaged. In the event of changes in the eye and / or if discomfort continues, consult a physician.

Following ingestion: Give plenty of lukewarm water and induce vomiting. Get medical attention if any discomfort occurs.

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

Silver in forms of granules and ingots is not hazardous. However, during production and some uses, the hazardous respirable silver-bearing particles may occur/be formed. This section considers the potential hazards caused by the vapours and dust containing silver associated with the production and processing of electrolytic silver

Acute intoxication symptoms:

Skin/eyes: direct contact may cause mild local irritation of the skin or eyes

Respiratory tract: inhalation of fumes or dusts of silver may be irritating to mucous membranes and upper respiratory tract. Exposure to high concentrations of fumes / dust may cause lung damage and pulmonary edema.

Alimentary system: ingestion of silver compounds can cause irritation of the digestive tract.

Long-term exposure:

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Prolonged exposure on dust/fume cause metallic taste in mouth, loss of appetite, headache and general weakness. It can also cause bluish or grayish discoloration of the skin, eyes and mucous membranes (*argyria*). It occurs slowly, it may take several years before it develops. These stains are irreversible.

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

If the victim is unconscious, make sure that the respiratory tract is not obstructed and place the victim in a recovery position. Provide immediate medical assistance.

SECTION 5. Firefighting measures

5.1 Extinguishing media:

Suitable extinguishing media: Non-flammable substance. Use firefighting measures appropriate to the surrounding materials.

Unsuitable extinguishing media: Not known. Do not use water on molten metal.

5.2 Special hazards arising from the substance or mixture:

The substance is fire-dangerous only in the form of vapors and dust.

5.3 Advice for fire-fighters:

Personnel participating in extinguishing a fire should wear protective, gas-tight clothes and apparatus isolating respiratory ways.

Follow the nature and size of the adjacent objects fire.

Additional information: Notify those in the surroundings about the fire. Remove all personnel not participating in the breakdown liquidation procedure from the area of hazard. Call fire department or police department.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

6.1.1 For non-emergency personnel: Do not inhale dusts. In case of choosing evacuation route consider the direction of the dust/fume movement.

6.1.2 For emergency responders: Do not inhale dusts. Personnel participating in rescue operation should wear protective, gas-tight clothes and apparatus isolating respiratory ways.

6.2 Environmental precautions:

Do not let the product penetrate the sewage system, ground and surface waters and soil. In case of accident, protect the substance against release to the environment.

6.3 Methods and material for containment and cleaning up:

Collect maximum quantity to proper containers in order to re-use it.

6.4 Reference to other sections

Personal protection equipment described in section 8.2.2

Disposal considerations in section 13.

SECTION 7. Handling and storage

7.1 Precautions for safe handling:

Wear protecting clothes and gloves. When handling the substance, do not drink, eat, smoke. Avoid generation and spreading of dust in the workplace.

7.2 Conditions for safe storage, including any incompatibilities:

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Do not store near: acetylene, ammonia, ozone, sulfur, hydrogen sulphide, halogens, mercury, alkali metal cyanides, nitric acid and sulfuric acid.

7.3 Specific end use(s):

Identified uses are listed in section 1.2.

SECTION 8. Exposure control/personal protection
8.1 Control parameters:

The following current national occupational exposure limit values apply (Poland):

No.	Substance name	TLV-TWA [mg/m ³]	TLV-STEL [mg/m ³]
1.	Silver – fumes and dusts	0,05	-
2.	Silver – insoluble compounds – calculated as Ag:	0,05	-
3.	Silver – soluble compounds – calculated as Ag:	0,01	-

The following current national occupational exposure limit values apply (European Union):

No.	Substance name	TLV-TWA [mg/m ³] *	TLV-STEL [mg/m ³]
1.	Silver, metallic	0,1	-
2.	Silver (soluble compounds as Ag)	0,01	-

* Measured or calculated in relation to a reference period of eight hours as a time-weighted average.

Inhalation DNELs (long-term and acute effects):

	mg Ag / m ³
Workers	
Soluble silver compound	0,01*
Poorly / insoluble silver compound	0,1**
General population	
Soluble silver compound	0,004*
Poorly / insoluble silver compound	0,04**

Oral DNELs (long-term effects):

	mg Ag / kg bm. / day
General population	
Soluble silver compound	0,02*
Poorly / insoluble silver compound	1,2**
Children	
Soluble silver compound	0,002*
Poorly / insoluble silver compound	0,12**

* Value for re-calculation only

** Value applicable to the substance "silver metal"

Note:

The recipient of this substance is obliged to control the work environment against concentration or intensity of harmful substances within frequency and range necessary to determine exposure rate of the employees according to national legislation in force.

Legal basis:

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Regulation of the Minister of Labour and Social Policy of November 29th, 2002 on the highest allowable concentrations and intensities of agents harmful for health in the work environment (Official Journal 02.217.1833 with subsequent amendments);

Directive 2000/39/EC of 8 June 2000 establishing a first list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work (Official Journal, 142, 16/06/2000);

Directive 2006/15/EC of 7 February 2006 establishing a second list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Directives 91/322/EEC and 2000/39/EC (Official Journal, 38, 9/2/2006).

8.2 Exposure controls:**8.2.1 Appropriate engineering controls at industrial settings**

During the production and processing of electrolytic silver ensure adequate local exhaust ventilation with housing in the area of vapours/dust emission to aerial environment and general ventilation of the room.

Any deposit of dust which cannot be avoided should be regularly removed preferably using appropriate industrial vacuum cleaners or central vacuum systems.

Waste air should be released into the atmosphere only after it has passed through suitable dust separators.

Waste water generated during the production process or cleaning operations should be collected and should preferably be treated in an on-site waste water treatment plant which ensures efficient removal of copper.

8.2.2 Individual protection measures, such as personal protective equipment**Eye/face protection:**

Not required. If there is a possibility of exposure to dust, wear goggles protect against fine dust. Do not wear contact lenses.

Hand protection:

Working gloves.

Skin protection:

Working clothes.

Respiratory protection:

If there is a possibility of exposure to dust use half-mask with filter of appropriate class for the designated concentrations in the air.

Thermal hazards:

Not applicable.

Hygiene measures:

Remove contaminated clothing. Clean contaminated clothing before reuse. After handling the product wash hands and face. Do not eat or drink while handling the product.

Additional Information:

During the production and processing of electrolytic silver use personal protection measures appropriate to the hazards in accordance with applicable law.

8.2.3. Environmental exposure controls:

Avoid release to the environment. Environmental exposure should be controlled in accordance with the national legislation on environmental protection.

SECTION 9. Physical and chemical properties

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9.1 Information on basic physical and chemical properties:

Appearance: product in the form of granules or ingots of a gray metallic color;

Odour: odourless

Odour threshold: n/a

pH: n/a

Melting point: 961,93 °C at 1013 hPa;

Initial boiling point: 2187 °C at 1013 hPa;

Flash point: not applicable n/a

Evaporation rate: n/a

Flammability: n/a

Explosive point: not applicable to a solid that melts > 300 °C

Vapour pressure: 0,013 Pa at 840 °C;

Vapour density: n/a

Density at 20 °C: 10,5 g/cm³

Solubility in water: 0,03 µg/L;

Partition coefficient n-octanol/water: n/a

Self-ignition point: n/a

Decomposition temperature: decomposition and/or melting starts at 1059 °C

Viscosity: n/a

Explosive properties: n/a

Oxidising properties: n/a

9.2 Other information:

None

SECTION 10. Stability and reactivity

10.1. Reactivity:

Non-reactive substance

10.2. Chemical stability:

The substance is stable.

10.3 Possibility of hazardous reactions:

N/a.

10.4 Conditions to avoid:

High temperature, contact with incompatible materials.

10.5 Incompatible materials:

Nitric acid, hot sulfuric acid, acetylene and its compounds, ammonia, ozone, sulfur, hydrogen sulphide, halogens, mercury, alkali metal cyanides.

10.6 Hazardous decomposition products:

The contact of silver with strong hydrogen peroxide solutions results in a rapid disintegration of the peroxide, releasing oxygen gas which increase the possibility of fire or explosion.

SECTION 11. Toxicological information

11.1 Information on toxicological effects:a) Acute toxicity:

on the basis of available data the classification criteria are not met.

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b) Skin corrosion/irritation:

on the basis of available data the classification criteria are not met.

c) Serious eye damage/ eye irritating:

on the basis of available data the classification criteria are not met.

d) Respiratory tract or skin sensitization:

on the basis of available data the classification criteria are not met.

e) Germ cell mutagenicity:

on the basis of available data the classification criteria are not met.

f) Carcinogenicity:

on the basis of available data the classification criteria are not met.

g) Reproductive toxicity:

on the basis of available data the classification criteria are not met.

h) Specific target organ toxicity — Single exposure:

on the basis of available data the classification criteria are not met.

i) Specific target organ toxicity — Repeated exposure:

on the basis of available data the classification criteria are not met.

j) Aspiration hazard:

on the basis of available data the classification criteria are not met.

Lethal and toxic doses and concentrations:

- LD₅₀ (rat, oral): > 2 000 mg/kg bm. (silver);
- LD₅₀ (rat, oral): 3702 mg/kg bm. (Ag₂O);
- LC₅₀ (rat, inhalation): no data;
- LD₅₀ (rat, dermal): no data;

11.2. Information on likely routes of exposure:

Routes of absorption for copper: inhalation, ingestion (swallowing), skin, eyes.

Respiratory tract: silver fumes or dust inhalation may be irritating to mucous membranes and upper respiratory tract. Exposure to high concentrations of fumes / dust may cause lung damage and pulmonary edema.

Alimentary system: silver ingestion may cause irritation of the stomach.

Skin and eyes: direct contact may cause mild local eyes or skin irritation.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

Detailed information on symptoms related to the product and the possible effects from exposure are described in Section 4.2.

SECTION 12. Ecological information

12.1. Toxicity:

On the basis of available data the environmental classification criteria are not met.

The data on the acute and chronic toxicity of silver ions to the aquatic environment are available for a wide range of freshwater and saltwater species. In most silver ions toxicity studies as the test material highly soluble in water silver nitrate was used.

Fish:Acute toxicity:

LC₅₀ (96 h), *Pimephales promelas*: 1.2 µg Ag /L

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LC₅₀ (96 h), *Oncorhynchus mykiss*: 1.48 µg Ag /LLC₅₀ (96 h), *Salmo gairdneri*: 6.5 µg Ag /L (soft water)LC₅₀ (96 h), *Salmo gairdneri*: 13 µg Ag /L (hard water)Chronic toxicity:EC₁₀ (217 d), *Salmo trutta*: 0.19 µg Ag/LEC₁₀ (217 d), *Salmo trutta*: 1.23 µg Ag/LEC₁₀ (196 d), *Oncorhynchus mykiss*: 0.17 µg Ag/LNOEC (32 d), *Pimephales promelas*: 0.351 µg Ag/L (growth inhibition)EC₁₀ (32 d), *Pimephales promelas*: 0.39 µg Ag/L (growth inhibition)EC₁₀ (32 d), *Pimephales promelas*: 0.44 µg Ag/L (lethality)**Crustaceans:**Acute toxicity:LC₅₀ (48 h), *Daphnia magna*: 0.22 µg Ag/LLC₅₀ (48 h), *Ceriodaphnia dubia*: 0.76 µg Ag/LChronic toxicity:EC₁₀ (7 d), *Ceriodaphnia dubia*: 2.48 µg Ag/L (effects on reproduction)EC₁₀ (21 d), *Daphnia magna*: 2.14 µg Ag/L (growth inhibition)NOEC (7 d), *Ceriodaphnia reticulata*: 1 µg Ag/L (effects on reproduction)**Algae:**Acute toxicity:EC₁₀ (24 h), *Chlamydomonas reinhardtii* : 0.54 µg Ag/L (growth inhibition)EC₁₀ (24 h), *Pseudokirchneriella subcapitata*: 0.41 µg Ag/L (growth inhibition)Chronic toxicity:NOEC (14 d), *Champia parvula*: 1.2 µg Ag/L**Predicted No-Effect Concentrations:**

PNEC (freshwater): 0.04 µg/L

PNEC (marine water): 0.86 µg/L

PNEC (freshwater sediment): 1.2 mg/kg sediment (dry mass)

PNEC (marine water sediment): 1.2 mg/kg sediment (dry mass)

12.2. Persistence and degradability:

The substance is stable.

12.3. Bioaccumulative potential:

According to the Chemical Safety Report for silver on silver bioaccumulation in living organisms there are several test results available on a variety of organisms. To develop silver safety assessment the study carried out on carp (*Cyprinus carpio*) was taken into account, in which the fish were exposed to approx. 0.2 mg Ag/L for 30 days. Bioconcentration factor (BCF) i.e. concentration coefficient of the substance (in this case silver) in the body in relation to its concentration in the surrounding aqueous environment for carp was 70. The BCF in fish of ≥ 500 is an indicative of the ability to bioconcentration.

12.4. Mobility in soil:

Silver ions react in the soil with CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- forming very slightly water-soluble compounds, therefore, they remain in the top layer of soil.

12.5. Results of PBT and vPvB assessment:

The substance is not classified as PBT or vPvB.

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12.6. Other adverse effects:

Silver is toxic to freshwater fish, as it causes abnormal sodium and chloride transport through membranes of gills cells. It is one of the most toxic metals for bacteria.

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

Proceedings in the case of waste arising: Do not dispose of to the sewage system. Do not let the substance to contamination of surface and ground water or soil. Do not dispose of at municipal landfills. Consider re-use. Recovery or disposal carried out in accordance with applicable regulations.

Manage the waste in accordance with the Directive of the European Parliament and of the Council 2006/12 / EC of 5 April 2006. On waste (OJ L 114, 27.04.2006, as amended. D.).

Disposal emptied packages: recycle steel securing bands.

SECTION 14: Transport information

The substance is not subject to regulations concerning the transport of dangerous goods.

14.1. UN number: n/a

14.2. UN proper shipping name: n/a

14.3. Transport hazard class(es): n/a

14.4. Packing group: n/a

14.5. Environmental hazards: n/a

14.6. Special precautions for user: n/a

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: n/a

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture**

Regulation (EC) No. 1907/2006 of the European Parliament and Council of December 18th, 2006 on Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH), creating European Chemicals Agency, changing the Directive 1999/45/EC as well as revoking the Council (EC) decree No 793/93 as well as the Commission Directive (EC) No. 1488/94 as well as the Council Directive 76/769/EWG and Council Directive 91/155/EEC, 93/67/EEC, 93/105/EC and 2006/21/EC. Regulation of the European Parliament and Council (EC) No. 1272/2008 dated December 16th, 2008 on classification, marking and packing hazardous substances and mixtures, changing and revoking the Directive 67/548/EEC and 1999/45/EEC as well as changing the Regulation (EC) No. 1907/2006. Act of February 25th 2011 on chemical substances and their mixtures (Official Journal No. 63, item 322) Regulation of the Minister of Labour and Social Policy of November 29th, 2002 on the highest allowable concentrations and intensities of substances harmful for health in the work environment (Official Journal No. 217, item 1833, with subsequent amendments); Act of April 27th, 2001, on waste (Official Journal No. 62, item 628, with subsequent amendments); Regulation of the Minister of Environment of September 27th, 2001 on the waste catalogue (Official Journal No. 112, item 1206); Act of May 11th, 2001, on packages and packages waste (Official Journal No. 63, item 638 with subsequent amendments); Regulation of the Commission (EC) No. 453/2010 of May 20th, 2010, changing the Regulation (EC) No. 1907/ 2007 of the European Parliament and Council on Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) (Official Journal L 133 with subsequent amendments).

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15.2. Chemical safety assessment

Chemical safety assessment of the substance has been carried out. Copper Chemical Safety Report is available at KGHM Polska Miedź S.A. "Głogów" Copper Smelter & Refinery.

SECTION 16: Other information

The material safety data sheet has been prepared according to Regulation of the Commission (EU) No. 453/2010 of May 20th, 2010 changing the regulation (EC) No. 1907/2006 of the European Parliament and Council on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Official Journal L 133, as amended) and the Regulation of the European Parliament and Council (EC) No. 1272/2008 dated December 16th, 2008, on classification, labeling and packing of hazardous substances and mixtures, changing and revoking the Directive 67/548/EEC and 1999/45/EEC as well as changing the Regulation (EC) No 1907/2006 (as amended).

Explanations of abbreviations and acronyms used in the MSDS:

CAS number – means numerical identification assigned to chemical substance by the American organization named Chemical Abstract Service (CAS), enabling substance identification.

Index number – it is an identification code given in part 3 of the annex VI to the Regulation of the European Parliament and Council (EC) No. 1272/2008 dated December 16th, 2008, on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006;

WE number – the number assigned to chemical substance in EINECS - European Inventory of Existing Chemical Substances, or the number assigned to chemical substance in ELINCS - European List of Notified Chemical Substances or the number in chemical substances inventory included in "No-longer polymers" document.

Registration number – number given by ECHA after substance/intermediate registration by the manufacturer/importer according to REACH Regulation.

UN number – unequivocal marking of hazardous substances and goods assigned by United Nations Central Committee to provide international recognition and use.

Name according to IUPAC – name of a substance given by IUPAC - International Union of Pure and Applied Chemistry Committee.

IUPAC name – name of a substance given by IUPAC - *International Union of Pure and Applied Chemistry Committee*.

NDS/TLV-TWA – the highest admissible concentration/threshold limit value – weighted average value – concentration of toxic chemical whose impact on a worker during 8-hour daily shift and average weekly time of work provided in the Labour Code during the period of his occupational activity should not cause negative changes of his health condition and of health condition of his next generations.

NDSCh/TLV-STEL – the highest admissible short term concentration/short term exposure limit – weighted average of concentration of the specified, toxic chemical compound which should not cause negative changes of a worker's health if present in the work environment for not longer than 15 minutes and not more often than twice per shift with occurrences separated by more than 1 hour.

LD₅₀ – lethal dose - dose of toxic substance expressed in milligrams per kilogram of body mass necessary to kill 50% of the examined population within specified time.

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LC₅₀ – lethal concentration - concentration of a substance in the inhaled air, expressed in milligrams per litre, which causes death of 50% of the examined population after specified period of exposure.

EC₁₀ – effect concentration - substance concentration expressed in milligrams per litre causing the given pharmacological effect (e.g. inhibition of growth) at 10% of the examined population within specified time.

EC₅₀ – effect concentration - substance concentration expressed in milligrams per litre causing the given pharmacological effect (e.g. inhibition of growth) at 50% of the examined population within specified time.

NOEC – no effect concentration - concentration of the substance expressed in milligrams per litre, at which no toxic effects can be observed.

DNEL – derived no-effect level is the level of exposure to a substance above which humans should not be exposed.

PNEC – predicted no-effect concentration is the concentration of a chemical which has no predicted effect on the environment.

Sources of information used during preparation of the MSDS:

- Own results of qualitative and quantitative analyses of the substance;
- Silver Chemical Safety Report,
- European Chemical Substance Information System (<http://ecb.jrc.ec.europa.eu/esis/>);
- TOXNET – Toxicology Data Network (<http://toxnet.nlm.nih.gov/>);
- ChemPortal - The Global Portal to Information on Chemical Substances (<http://webnet3.oecd.org/eChemPortal/Home.aspx>);
- „Encyclopedia of technology, vol. Chemistry”, Publ. WNT, Warsaw, 1965r.
- „CHEMYSTRY structure & reactions”, Milton K. Synder, Science Technology Publ., Warsaw, 1975r.
- *Silver Metal Material Safety Data Sheet*. Teck Metals Ltd., Vancouver, Canada
- *Silver Powder, spherical Material Safety Data Sheet*. Alfa Aesar, A Johnson Matthey Company, Ward Hill, USA.

Necessary training: Post-related training within the scope of safe use of a substance considering its hazardous properties for human and the environment.

Information contained in the material safety data sheet is to describe the product within the scope of safety requirements. User is responsible for taking any steps in order to meet the provisions of the national law and to create safe conditions for use of the product. User is held responsible for effects resulting from improper application of this product.

Further information can be obtained under the telephone numbers given in section 1.