

## SAFETY DATA SHEET

### 1. SUBSTANCE AND SOURCE IDENTIFICATION

**Product Identifier**

**RM Number:** 8017  
**RM Name:** Polyvinylpyrrolidone Coated Silver Nanoparticles (Nominal Diameter 75 nm)  
**Other Means of Identification:** Not applicable.

**Recommended Use of This Material and Restrictions of Use**

This Reference Material (RM) is intended primarily for use as a benchmark and investigative tool for the evaluation of potential environmental, health, and safety risks that may be associated with manufactured nanomaterials during their product life-cycle. A unit of RM 8017 consists of five glass serum vials with butyl stoppers sealed under vacuum and containing a lyophilized polyvinylpyrrolidone-(PVP) coated silver (Ag) nanoparticle cake. Each vial contains nominally 2 mg of Ag and 20 mg of PVP (molar mass approximately 40 kDa). The RM must be reconstituted with 2 mL of deionized water before use; the reconstituted Ag concentration is nominally 1 mg/mL.

**Company Information**

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 Standard Reference Materials Program  
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### 2. HAZARDS IDENTIFICATION

**Note:** When reconstituted, the concentration of polyvinylpyrrolidone coated silver nanoparticles is below the reportable limit for SDS information as required by OSHA 29 CFR 1910.1200. This material and derived solutions should be handled as recommended by the National Institute for Occupational Safety and Health (NIOSH). According to NIOSH, occupational health risks associated with manufacturing and using nanomaterials are not fully understood. Minimal information is currently available on dominant exposure routes, potential exposure levels, and material toxicity of nanomaterials.

**Classification**

**Physical Hazard:** Not classified.  
**Health Hazard:** Not classified.

**Label Elements**

**Symbol:**  
 No Symbol

**Signal Word:**  
 No Signal Word

**Hazard Statement(s):** Not applicable.

**Precautionary Statement(s):** Not applicable.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.

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### 3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

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**Substance:** Lyophilized polyvinylpyrrolidone (PVP) coated silver (Ag) nanoparticle cake

**Other Designations:**

Silver: algaedyn; argentum; silver element; silver metal; Ag

Polyvinylpyrrolidone: 2-pyrrolidinone, 1-ethenyl, homopolymer; 1-ethenyl-2-pyrrolidinone homopolymer; PVP

Components are listed in compliance with OSHA's 29 CFR 1910.1200.

Non-Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Silver	7440-22-4	231-131-3	>95
Polyvinylpyrrolidone	9003-39-8	not applicable	<5

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### 4. FIRST AID MEASURES

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**Description of First Aid Measures:**

**Inhalation:** If adverse effects occur, remove to uncontaminated area. Get medical attention.

**Skin Contact:** Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention.

**Eye Contact:** Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

**Ingestion:** If a large amount is swallowed, get medical attention.

**Most Important Symptoms/Effects, Acute and Delayed:** Irritation.

**Indication of any immediate medical attention and special treatment needed, if necessary:** If adverse effects are present, seek immediate medical attention.

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### 5. FIRE FIGHTING MEASURES

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**Fire and Explosion Hazards:** Negligible fire hazard in solid form.

**Extinguishing Media:**

Suitable: Use water spray, alcohol-resistant foam, dry chemical, or carbon dioxide.

Unsuitable: None listed.

**Specific Hazards Arising from the Chemical:** Thermal decomposition will form oxides of carbon, nitrogen.

**Special Protective Equipment and Precautions for Fire-Fighters:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

**NFPA Ratings** (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 0                  Fire = 0                  Reactivity = 0

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### 6. ACCIDENTAL RELEASE MEASURES

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**Personal Precautions, Protective Equipment and Emergency Procedures:** Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

**Methods and Materials for Containment and Clean up:** Notify safety personnel of spills. Do not touch spilled material. Collect spilled material in appropriate container for disposal. Dry spill can be swept up and or flushed with water. Solid services should be wiped cleaned with a detergent based cleaner.

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### 7. HANDLING AND STORAGE

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**Safe Handling Precautions:** See Section 8, "Exposure Controls and Personal Protection".

**Storage:** Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances. See the NIST Report of Investigation for additional storage information.

## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

**Exposure Limits:** No occupational limits established for PVP coated nanoparticles.

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles. An eye wash station should be readily available near areas of use.

**Skin and Body Protection:** Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties	Silver (>95 % of this RM)	PVP (<5 % of this RM)	Reconstituted Solution
<b>Appearance (physical state, color, etc.):</b>	solid lustrous white solid	white to yellow solid	grey liquid
<b>Molecular Formula:</b>	Ag	(C <sub>6</sub> H <sub>9</sub> NO) <sub>x</sub>	not applicable
<b>Molar Mass (g/mol):</b>	107.868	(111.14) <sub>x</sub>	not applicable
<b>Odor:</b>	not available	odorless	not available
<b>Odor threshold:</b>	not available	not available	not available
<b>pH:</b>	not available	3 to 7 (5 % solution)	4.3 (Value provided in NIST ROI.)
<b>Evaporation rate:</b>	not available	not available	not available
<b>Melting point/freezing point:</b>	962 °C (1763.6 °F)	not available	not available
<b>Relative Density (g/L):</b>	10.5	not available	not available
<b>Specific Gravity (water = 1):</b>	not available	1.23 to 1.29	not available
<b>Vapor Pressure (mmHg):</b>	100 at 1865 °C	not available	not available
<b>Vapor Density (air = 1):</b>	not available	not available	not available
<b>Viscosity (cP):</b>	not available	not available	not available
<b>Solubility(ies):</b>	insoluble in water; soluble in nitric acid, hot sulfuric acid, potassium cyanide solutions, alkali hydroxide solutions, alkali cyanide solution	insoluble in ether; soluble in water, alcohol, chloroform, organic solvents	not available
<b>Partition coefficient (n-octanol/water):</b>	not available	not available	not available
<b>Particle Size (nominal diameter, dry, deposited on substrate):</b>	75 nm	75 nm	not applicable
<b>Thermal Stability Properties</b>			
<b>Autoignition Temperature:</b>	not available	not available	not available
<b>Thermal Decomposition:</b>	not available	not available	not available
<b>Initial boiling point and boiling range:</b>	2122 °C (3851.6 °F)	not available	not available
<b>Explosive Limits, LEL (Volume %):</b>	not available	not available	not available
<b>Explosive Limits, UEL (Volume %):</b>	not available	not available	not available
<b>Flash Point:</b>	not available	not available	not available
<b>Flammability (solid, gas):</b>	not available	not available	not available

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## 10. STABILITY AND REACTIVITY

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**Reactivity:** Stable at normal temperature and pressure.

**Stability:**  Stable  Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** None reported.

**Incompatible Materials:** Oxidizing materials, reducing agents, combustible materials, bases, halo carbons, halogens, peroxides, and acids.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** No data available.

**Hazardous Polymerization:**  Will Occur  Will Not Occur

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## 11. TOXICOLOGICAL INFORMATION

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**Route of Exposure:**  Inhalation  Skin  Ingestion

**Symptoms Related to the Physical, Chemical and Toxicological Characteristics:** Irritation.

**Potential Health Effects (Acute, Chronic and Delayed):**

**Inhalation:** If dust is generated, respiratory tract irritation is possible.

**Skin Contact:** Irritation may occur; may be harmful by skin absorption.

**Eye Contact:** Irritation may occur; may damage the eyes.

**Ingestion:** May be harmful if ingested.

**Numerical Measures of Toxicity:**

**Acute Toxicity:** Not classified.

Silver, Rat Oral LD50: >2000 mg/kg

PVP, Rat Oral LD50: 100 g/kg

**Skin Corrosion/Irritation:** No data available.

**Serious Eye Damage/Irritation:** No data available

**Respiratory Sensitization:** No data available.

**Skin Sensitization:** No data available.

**Germ Cell Mutagenicity:** No data available.

**Carcinogenicity:** Not classified.

**Listed as a Carcinogen/Potential Carcinogen**  Yes  No

Silver is not listed by NTP, IARC or OSHA as a carcinogen/potential carcinogen.

PVP is listed by IARC as Group 3, *not classifiable* and is not listed by NTP or OSHA.

**Tumorigenic:**

Silver: Rat Implant TDLo: 2400 mg/kg

Rat Multiple TDLo: 330 mg/kg (43 week)

PVP: Rat Intraperitoneal TDLo: 2500 mg/kg

Rat Subcutaneous TDLo: 1000 mg/kg

**Reproductive Toxicity:** No data available.

**Specific Target Organ Toxicity, Single Exposure:** No data available.

**Specific Target Organ Toxicity, Repeated Exposure:** No data available.

**Aspiration Hazard:** No data available.

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## 12. ECOLOGICAL INFORMATION

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### Ecotoxicity Data:

Silver: Fathead minnow (*Pimephales promelas*) LC50 [static]: 0.00155 mg/L to 0.00293 mg/L (96 h)

Water flea (*Daphnia magna*) EC50 [static]: 0.00024 mg/L (48 h)

PVP: No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse effects:** No data available.

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## 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** Dispose of waste in accordance with all applicable federal, state, and local regulations. Silver is subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D011, at or above the Regulatory level of 5.0 mg/L.

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## 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** This material is not regulated by DOT or IATA.

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## 15. REGULATORY INFORMATION

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### U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not applicable to the identified NIST RM.

SARA Title III Section 302 (40 CFR 355.30): Not applicable to the identified NIST RM.

SARA Title III Section 304 (40 CFR 355.40): Not applicable to the identified NIST RM.

SARA Title III Section 313 (40 CFR 372.65): Not applicable to the identified NIST RM.

OSHA Process Safety (29 CFR 1910.119): Not applicable to the identified NIST RM.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: No.

CHRONIC HEALTH: No.

FIRE: No.

REACTIVE: No.

PRESSURE: No.

### State Regulations:

California Proposition 65: Not listed.

**U.S. TSCA Inventory:** Silver and PVP are listed.

**TSCA 12(b), Export Notification:** Not listed.

### Canadian Regulations:

WHMIS Information: Not provided for this material.

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## 16. OTHER INFORMATION

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**Issue Date:** 03 December 2014

**Sources:** ChemAdvisor, Inc., SDS *Silver*, 10 September 2014.

ChemAdvisor, Inc., SDS *Polyvinylpyrrolidone*, 10 September 2014.

NanoComposix, Inc., Vendor MSDS *Econix Silver Nanoparticle Powder (AGPE)*, 26 June 2011.

NIOSH Publications, *Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials*; available at <http://www.cdc.gov/niosh/docs/2009-125/> (accessed Dec 2014).

NIOSH Publications, *General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories*; available at <http://www.cdc.gov/niosh/docs/2012-147/> (accessed Dec 2014).

### Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
NIOSH	National Institute for Occupational Safety and Health	UEL	Upper Explosive Limit
NIST	National Institute of Standards and Technology	WHMIS	Workplace Hazardous Materials Information System
n.o.s.	Not Otherwise Specified		

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The assigned values for this material are given in the NIST Report of Investigation.

Users of this RM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.