

# SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006 (REACH)

Revision date: 6 Aug 2021

Print date: 26 Jan 2022

Version: 5



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## FK9611

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

#### 1.1. Product identifier

Trade name/designation:

FK9611

Other means of identification:

RuO2 thick film paste for AlN FK9611

Article No.:

10051

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

Use of the substance/mixture:

thick film ink

Relevant identified uses:

**Life cycle stage [LCS]**

**IS:** Use at industrial sites

**Sector of uses [SU]**

**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites

**Product Categories [PC]**

**PC 9a:** Coatings and paints, thinners, paint removers

**Process categories [PROC]**

**PROC 10:** Roller application or brushing

**Environmental release categories [ERC]**

**ERC 5:** Use at industrial site leading to inclusion into/onto article

**Article categories [AC]**

**AC 0:** Other

#### 1.3. Details of the supplier of the safety data sheet

Supplier (manufacturer/importer/only representative/downstream user/distributor):

**Fraunhofer IKTS-DD, TFC, RS**

Dickschichttechnik und funktioneller Druck | Thick-Film Technology and Functional Printing

Winterbergstraße 28

01277 Dresden

Germany

**Telephone:** +49-351-2553-7916

**Telefax:** +49-351-2554-236

**E-mail:** service@ikts-tfc.de

**Website:** www.ikts.fraunhofer.de

**E-mail (competent person):** service@ikts-tfc.de

#### 1.4. Emergency telephone number

Richard Schmidt, +49-351-2553-7916/-7900 (Only available during office hours.)

### SECTION 2: Hazards identification

#### \* 2.1. Classification of the substance or mixture

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

Hazard classes and hazard categories	Hazard statements	Classification procedure
Skin corrosion/irritation ( <i>Skin Irrit. 2</i> )	H315: Causes skin irritation.	Calculation method.
Serious eye damage/eye irritation ( <i>Eye Irrit. 2</i> )	H319: Causes serious eye irritation.	Calculation method.
Acute toxicity (inhalative) ( <i>Acute Tox. 4</i> )	H332: Harmful if inhaled.	Calculation method.

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Hazard classes and hazard categories	Hazard statements	Classification procedure
Hazardous to the aquatic environment ( <i>Aquatic Chronic 3</i> )	H412: Harmful to aquatic life with long lasting effects.	Calculation method.

### \* 2.2. Label elements

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

Hazard pictograms:



**GHS07**

Exclamation mark

**Signal word:** Warning

Hazard statements for health hazards	
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.

Hazard statements for environmental hazards	
H412	Harmful to aquatic life with long lasting effects.

**Supplemental hazard information:** —

Precautionary statements Prevention	
P280	Wear protective gloves/protective clothing and eye/face protection.

Precautionary statements Response	
P302 + P352	IF ON SKIN: Wash with plenty of water/Soap.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/attention.
P337 + P313	If eye irritation persists: Get medical advice/attention.

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

#### Special rules for supplemental label elements for certain mixtures:

23,4 % percent of the mixture consists of ingredient(s) of unknown acute toxicity (oral).

23,4 % percent of the mixture consists of ingredient(s) of unknown acute toxicity (dermal).

92,7 % percent of the mixture consists of ingredient(s) of unknown acute toxicity (inhalative).

73,2 % percent of the mixture consists of components of unknown hazards to the aquatic environment.

### 2.3. Other hazards

No data available

## SECTION 3: Composition/information on ingredients

### \* 3.2. Mixtures

#### Description:

Precious metals, glass and inorganic additives embedded in an organic vehicle.

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### Hazardous ingredients / Hazardous impurities / Stabilisers:

Product identifiers	Substance name Classification according to Regulation (EC) No 1272/2008 [CLP]	Concentration
CAS No.: 8000-41-7 EC No.: 232-268-1	<b>Terpineol</b> Eye Irrit. 2 (H319), Skin Irrit. 2 (H315)  <b>Warning</b>	16 - < 27 weight-%
CAS No.: 1313-13-9 EC No.: 215-202-6	<b>manganese dioxide</b> Acute Tox. 4 (H302, H332), STOT RE 2 (H373)  <b>Warning</b>	4 - ≤ 8 weight-%

Full text of H- and EUH-phrases: see section 16.

## SECTION 4: First aid measures

### \* 4.1. Description of first aid measures

#### General information:

In case of accident or unwellness, seek medical advice immediately (show directions for use or safety data sheet if possible). Remove victim out of the danger area. Remove contaminated, saturated clothing. If unconscious but breathing normally, place in recovery position and seek medical advice. Do not leave affected person unattended.

#### Following inhalation:

Provide fresh air. In case of respiratory tract irritation, consult a physician.

#### In case of skin contact:

After contact with skin, wash immediately with plenty of water and soap. If skin irritation or rash occurs: Get medical advice/attention. Take off immediately all contaminated clothing.

#### After eye contact:

Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Consult an ophthalmologist.

#### Following ingestion:

Rinse mouth. Get medical advice/attention if you feel unwell.

#### Self-protection of the first aider:

Use personal protection equipment. No direct artificial respiration to be given by first aider.

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

Skin corrosion/irritation Serious eye damage/eye irritation

### 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:

Water spray jet, Extinguishing powder, alcohol resistant foam, Carbon dioxide (CO<sub>2</sub>). Co-ordinate fire-fighting measures to the fire surroundings.

#### Unsuitable extinguishing media:

Full water jet

### \* 5.2. Special hazards arising from the substance or mixture

#### Hazardous combustion products:

Gases/vapours, toxic (CO, CO<sub>2</sub>)

### 5.3. Advice for firefighters

Wear a self-contained breathing apparatus and chemical protective clothing.

### 5.4. Additional information

Collect contaminated fire extinguishing water separately. Do not allow entering drains or surface water.

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## SECTION 6: Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

#### 6.1.1. For non-emergency personnel

**Personal precautions:**

Remove persons to safety.

**Protective equipment:**

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

#### 6.1.2. For emergency responders

**Personal protection equipment:**

Personal protection equipment: see section 8

### 6.2. Environmental precautions

Do not allow to enter into surface water or drains.

\* **6.3. Methods and material for containment and cleaning up**

**For containment:**

Absorb with liquid-binding material (sand, diatomaceous earth, acid- or universal binding agents).

**For cleaning up:**

Water (with cleaning agent)

### 6.4. Reference to other sections

Safe handling: see section 7 Personal protection equipment: see section 8 Disposal: see section 13

### 6.5. Additional information

Use appropriate container to avoid environmental contamination.

## SECTION 7: Handling and storage

\* **7.1. Precautions for safe handling**

**Protective measures**

**Advices on safe handling:**

Wear personal protection equipment (refer to section 8).

**Fire prevent measures:**

The formation of combustible vapours is possible at temperatures above: 88 °C

**Environmental precautions:**

Do not allow to enter into surface water or drains.

**Advices on general occupational hygiene**

When using do not eat, drink or smoke. Avoid contact with eyes and skin.

\* **7.2. Conditions for safe storage, including any incompatibilities**

**Technical measures and storage conditions:**

Store in a well-ventilated place.

**Packaging materials:**

Keep/Store only in original container.

**Requirements for storage rooms and vessels:**

Keep container tightly closed.

**Hints on storage assembly:**

Prohibition on mixed storage has to be followed

**Storage class (TRGS 510, Germany):** 10 - Combustible liquids that cannot be assigned to any of the above storage classes

### 7.3. Specific end use(s)

**Recommendation:**

Observe technical data sheet.

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## SECTION 8: Exposure controls/personal protection

### \* 8.1. Control parameters

#### 8.1.1. Occupational exposure limit values

Limit value type (country of origin)	Substance name	① Long-term occupational exposure limit value ② Short-term occupational exposure limit value ③ Instantaneous value ④ Monitoring and observation processes ⑤ Remark
RU	ruthenium (IV) oxide CAS No.: 12036-10-1 EC No.: 234-840-6	③ 1 mg/m <sup>3</sup>

#### 8.1.2. Biological limit values

No data available

#### 8.1.3. DNEL-/PNEC-values

No data available

### \* 8.2. Exposure controls

#### 8.2.1. Appropriate engineering controls

Technical measures and the application of suitable work processes have priority over personal protection equipment.

#### 8.2.2. Personal protection equipment



##### Eye/face protection:

Eye glasses with side protection (EN 166).

##### Skin protection:

Tested protective gloves must be worn (EN ISO 374) Suitable material: NBR (Nitrile rubber) 0,4 mm. Breakthrough time: 480 min.

##### Respiratory protection:

If technical exhaust or ventilation measures are not possible or insufficient, respiratory protection must be worn.

#### 8.2.3. Environmental exposure controls

See section 7. No additional measures necessary.

## SECTION 9: Physical and chemical properties

### \* 9.1. Information on basic physical and chemical properties

#### Appearance

**Physical state:** Liquid

**Colour:** black

**Odour:** not determined

#### Safety relevant basis data

Parameter	Value	at °C	① Method ② Remark
pH	<i>not determined</i>		
Melting point	<i>not determined</i>		
Freezing point	<i>not determined</i>		
Initial boiling point and boiling range	≥ 214 - ≤ 224 °C		② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Decomposition temperature	<i>not determined</i>		

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Parameter	Value	at °C	① Method ② Remark
Flash point	= 88 °C		② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Evaporation rate	<i>not determined</i>		
Auto-ignition temperature	= 264 °C		② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Upper/lower flammability or explosive limits	<i>not determined</i>		
Vapour pressure	= 0.24 hPa	20 °C	② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Vapour density	<i>not determined</i>		
Density	= 2.25 g/cm <sup>3</sup>	25 °C	② calculated from ingredients
Relative density	<i>not determined</i>		
Bulk density	<i>not determined</i>		
Water solubility	= 2.54 g/l	20 °C	② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Partition coefficient: n-octanol/water	= 2.6		② Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)
Dynamic viscosity	≥ 190 - ≤ 250 Pa*s	25 °C	① Brookfield SC4-14/-6R // n=10 U/min
Kinematic viscosity	<i>not determined</i>	40 °C	

### 9.2. Other information

No data available

## SECTION 10: Stability and reactivity

### \* 10.1. Reactivity

No hazardous reaction when handled and stored according to provisions.

### 10.2. Chemical stability

The product is chemically stable under recommended conditions of storage, use and temperature.

### 10.3. Possibility of hazardous reactions

No known hazardous reactions.

### 10.4. Conditions to avoid

Do not store at temperatures above 30°C

### 10.5. Incompatible materials

Acid, Alkali (lye), Oxidising agent, strong

### \* 10.6. Hazardous decomposition products

No data available

## SECTION 11: Toxicological information

### \* 11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Substance name	Toxicological information
Terpineol CAS No.: 8000-41-7 EC No.: 232-268-1	<b>LD<sub>50</sub> oral:</b> =4,300 mg/kg (Ratte) OECD 401 <b>LD<sub>50</sub> dermal:</b> >2,000 mg/kg (Rat) OECD 402
manganese dioxide CAS No.: 1313-13-9 EC No.: 215-202-6	<b>LD<sub>50</sub> oral:</b> >3,480 mg/kg (Rat)

### Acute oral toxicity:

Based on available data, the classification criteria are not met.

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### Acute dermal toxicity:

Based on available data, the classification criteria are not met.

### Acute inhalation toxicity:

Harmful if inhaled.

### Skin corrosion/irritation:

Causes skin irritation.

### Serious eye damage/irritation:

Causes serious eye irritation.

### Respiratory or skin sensitisation:

Based on available data, the classification criteria are not met.

### Germ cell mutagenicity:

Based on available data, the classification criteria are not met.

### Carcinogenicity:

Based on available data, the classification criteria are not met.

### Reproductive toxicity:

Based on available data, the classification criteria are not met.

### STOT-single exposure:

Based on available data, the classification criteria are not met.

### STOT-repeated exposure:

Based on available data, the classification criteria are not met.

### Aspiration hazard:

Based on available data, the classification criteria are not met.

### Additional information:

No data available

## 11.2. Information on other hazards

No data available

## SECTION 12: Ecological information

### \* 12.1. Toxicity

Substance name	Toxicological information
Terpineol CAS No.: 8000-41-7 EC No.: 232-268-1	LC <sub>50</sub> : =70 mg/l 4 d (fish, Danio rerio (zebrafish)) OECD 203 LC <sub>50</sub> : ≈68 mg/l 3 d (Algae/water plant, Pseudokirchneriella subcapitata) OECD 201 LC <sub>50</sub> : =73 mg/l 2 d (crustaceans, Daphnia magna (Big water flea)) OECD 202

### Aquatic toxicity:

Harmful to aquatic life with long lasting effects.

## 12.2. Persistence and degradability

Substance name	Biodegradation	Remark
Terpineol CAS No.: 8000-41-7 EC No.: 232-268-1	—	SDB Terpineol Version 6.4 von Sigma Aldrich (englisch), überarbeitet am 23.03.2021; WGK laut Kenn-Nummer 3.477 nach AwSV, Anlage 1 (4)
manganese dioxide CAS No.: 1313-13-9 EC No.: 215-202-6	not determined	WGK-Einstufung nach Kenn-Nummer 7.145 - VwVwS

## 12.3. Bioaccumulative potential

### Partition coefficient: n-octanol/water:

= 2.6; Remark: Overtaken from SDS of the organic solvent of the paste (CAS#8000-41-7)

## 12.4. Mobility in soil

No data available

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### 12.5. Results of PBT and vPvB assessment

Substance name	Results of PBT and vPvB assessment
Terpineol CAS No.: 8000-41-7 EC No.: 232-268-1	—
manganese dioxide CAS No.: 1313-13-9 EC No.: 215-202-6	—

### 12.6. Endocrine disrupting properties

No data available

### 12.7. Other adverse effects

No data available

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

Handle contaminated packages in the same way as the substance itself.

#### 13.1.1. Product/Packaging disposal

#### Waste codes/waste designations according to EWC/AVV

##### Waste code product

16 05 06 *	laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals
------------	--

\*: Evidence for disposal must be provided.

### Waste treatment options

#### Appropriate disposal / Product:

Dispose of waste according to applicable legislation. Consult the appropriate local waste disposal expert about waste disposal.

#### Appropriate disposal / Package:

Completely emptied packages can be recycled.

## SECTION 14: Transport information

Land transport (ADR/RID)	Inland waterway craft (ADN)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
<b>14.1. UN number or ID number</b>			
No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.
<b>14.2. UN proper shipping name</b>			
No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.	No dangerous good in sense of these transport regulations.
<b>14.3. Transport hazard class(es)</b>			
not relevant	not relevant	not relevant	not relevant
<b>14.4. Packing group</b>			
not relevant	not relevant	not relevant	not relevant
<b>14.5. Environmental hazards</b>			
not relevant	not relevant	not relevant	not relevant
<b>14.6. Special precautions for user</b>			
not relevant	not relevant	not relevant	not relevant

### 14.7. Maritime transport in bulk according to IMO instruments

No data available



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## SECTION 15: Regulatory information

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

No data available

### 15.2. Chemical Safety Assessment

Chemical safety assessments for substances in this mixture were not carried out.

## SECTION 16: Other information

### \* 16.1. Indication of changes

1.2.	Relevant identified uses of the substance or mixture and uses advised against
2.1.	Classification of the substance or mixture
2.2.	Label elements
3.2.	Mixtures
4.1.	Description of first aid measures
5.2.	Special hazards arising from the substance or mixture
6.3.	Methods and material for containment and cleaning up
7.1.	Precautions for safe handling
7.2.	Conditions for safe storage, including any incompatibilities
8.1.	Control parameters
8.2.	Exposure controls
9.1.	Information on basic physical and chemical properties
10.1.	Reactivity
10.6.	Hazardous decomposition products
11.1.	Information on hazard classes as defined in Regulation (EC) No 1272/2008
12.1.	Toxicity
16.1.	Indication of changes

### 16.2. Abbreviations and acronyms

No data available

### 16.3. Key literature references and sources for data

No data available

### 16.4. Classification for mixtures and used evaluation method according to regulation (EC) No 1272/2008 [CLP]

Hazard classes and hazard categories	Hazard statements	Classification procedure
Skin corrosion/irritation ( <i>Skin Irrit. 2</i> )	H315: Causes skin irritation.	Calculation method.
Serious eye damage/eye irritation ( <i>Eye Irrit. 2</i> )	H319: Causes serious eye irritation.	Calculation method.
Acute toxicity (inhalative) ( <i>Acute Tox. 4</i> )	H332: Harmful if inhaled.	Calculation method.
Hazardous to the aquatic environment ( <i>Aquatic Chronic 3</i> )	H412: Harmful to aquatic life with long lasting effects.	Calculation method.

### 16.5. Relevant R-, H- and EUH-phrases (Number and full text)

Hazard statements	
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H373	May cause damage to organs through prolonged or repeated exposure.

### 16.6. Training advice

No data available

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### 16.7. Additional information

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

\* Data changed compared with the previous version