

Nickel Oxide

(In accordance to Regulation (EC) No. 1907/2006, Annex II, as amended by Regulation (EU) 2015/830)

Section 1. Identification of the Substance and Company

1.1 Product Identification:

Product Name: Nickel Oxide

Synonyms:

Nickel oxide sinter 75

NOS75

Nickel (II) Oxide

FMW

FEW

FEN

Green nickel oxide

Nickel oxide (NiO)

Nickel monoxide

Japanese Nickel Oxide

TNOS

Bunsenite

Ni Oxide Chunks

EC No: 215-215-7 / 234-323-5

CAS No: 1313-99-1 / 11099-02-8

***REACH Registration number:* see Section 15**

1.2 Relevant Identified Uses of the Substance or mixture and Uses Advised Against

Identified Uses:

Formulation or re-packing; Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors

Use at industrial sites; Use of nickel oxide containing catalysts

Use at industrial sites; Use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts

Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing powders

Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing frits

Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing inorganic pigments

Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing glass

Use at industrial sites; Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process)

Use at industrial sites; Use of nickel oxide sinter in the production of stainless, special steels and special alloy

Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics

Use at industrial sites; Use of nickel oxide powder for the production of nickel zinc ferrite cores

Service life (worker at industrial site); Service life of nickel-containing electronics/ferrite cores in industrial settings

Service life (professional worker); Service life of nickel-containing electronics/ferrite cores in professional settings

Use at industrial sites; Use of nickel oxide for the production of nickel oxide containing automotive catalysts

Service life (worker at industrial site); Production of vehicle exhaust systems in industrial settings

Service life (professional worker); Service life of vehicle exhaust systems in professional settings

Uses Advised Against:

Use of nickel and nickel compounds in tattoo inks or permanent makeup products.

1.3 Details of the Supplier of the Safety Data Sheet

Manufactured by:

Vale Canada Limited
Ontario Operations
Sudbury, ON
Canada PoM 1No

Vale Japan Limited
Matsusaka Plant
345-52 Ryoshicho, Matsusaka City
Mie 515-0802, Japan

Distributed by:

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Suite 1600, South Tower, PO Box 70
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REACH Only Representative for Vale Japan
H2 Compliance
Rubicon Building, CIT Campus
T12Y275, Bishopstown
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Telephone number: +353-21-486-8121
Email: Chris.Terrett@h2compliance.com

Imported by:

In North & South America

Vale Americas Inc.
140 E. Ridgewood Avenue
Suite 415, South Tower
Paramus, NJ 07652
U.S.A

In Asia (Except India & Pakistan)

Vale Base Metals Asia Pacific PTE. Ltd
One Temasek Avenue #39-01
Millenia Tower
Singapore, 039192

In Europe, Middle East, Africa, India & Pakistan

Vale International SA
Route de Pallatex 29
1162 Saint-Prex
Switzerland

1.4 Emergency Telephone Number

For Fire, Spill, or chemical emergency call CHEMTREC: +1 703 527-3887
for Europe call CHEMTREC: +(44) 870 8200

[Section 2. Hazards Identification](#)

2.1 Classification of the Substance:

Classification according Regulation (EC) No. 1272/2008

Acute toxicity inhalation – Category 4

Skin Sensitization – Category 1

Respiratory Sensitization – Category 1

Carcinogenicity – Category 1A

Specific Target Organ Toxicity, Repeated exposure – Category 1

Aquatic Chronic – Category 3

Hazard Pictograms:

GHS07 - Exclamation mark, GHS08 - Health Hazard,

Signal Word:

Danger

Hazard Statements:

H332 – Harmful if inhaled
 H317 - May cause an allergic skin reaction
 H334 – May cause allergy or asthma symptoms or breathing difficulties if inhaled
 H350 - May cause cancer by inhalation
 H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
 H412 –Harmful to aquatic life with long lasting effects.

Precautionary Statements:

P201, P202, P260, P261, P264, P270, P271, P272, P273, P280, P284, P302+P352, P304+P340, P308+P313, P333+P313, P314, P321, P342+P311, P362+P364, P405, P501

2.2: Label elements

Product identifier: Nickel Oxide

CAS #: 1313-99-1 / 11099-02-8

Symbols:

GHS07 - Exclamation mark

GHS08 - Health Hazard



Signal Word:

Danger

Hazard Statements:

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 H350 - May cause cancer by inhalation
 H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
 H412 –Harmful to aquatic life with long lasting effects.

Precautionary Statements:

P202 – Do not handle until all safety precautions have been read and understood
 P261 - Avoid breathing dust or fume; Wear respiratory protective equipment if fine dusts are generated
 P273 - Avoid release to the environment.
 P302+P352 - If on skin: Wash with plenty of soap and water.

P501 - Dispose of contents/container in accordance to local/regional/national/international regulations

2.3: Other hazards

The PBT and vPvB criteria of Annex XIII of the REACH Regulation does not apply to inorganic substances, such as nickel oxide.

2.4: Additional Information

For full text of Precautionary statements see section 16.

Section 3. Composition

3.1 Substances

Substance **Mixture**
 Typical Analysis:

| Hazardous Ingredients | Typical Composition (%) | C.A.S. Number | EINECS/EC Label No. |
|-----------------------|-------------------------|---------------|---------------------|
| Nickel Oxide (NiO) | 90-96 | 1313-99-1 | 215-215-7 |
| Copper Oxide (CuO) | 0.2-9.0 | 1317-38-0 | 215-269-1 |
| Cobaltous Oxide (CoO) | 0.5- 1.5 | 1307-96-6 | 215-154-6 |
| Nickel hydroxide | 0 – 0.5 | 12054-48-7 | 235-008-05 |

3.2 Mixtures

Not applicable

Section 4. First Aid Measures

4.1 Description of first aid measures

| | |
|--------------|--|
| Inhalation | No specific first aid required. Remove person to fresh air and keep comfortable for breathing. |
| Skin Contact | Remove contaminated clothing, and wash affected areas thoroughly with soap and water. If skin irritation or rash occurs: Get medical advice/attention. |
| Eye Contact | Irrigate eyeball thoroughly with water for at least 10 minutes. If discomfort persists, seek medical attention. |

Ingestion No specific first aid required. Get medical attention if you feel unwell.

4.2 Most important symptoms and effects, both acute and delayed

May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.

4.3 Indication of any immediate attention and special treatment needed

If exposed or concerned: Get medical advice attention.

Section 5. Fire Fighting Measures

5.1 Extinguishing media

Suitable extinguishing media Any, type to be selected according to materials stored in the immediate neighbourhood

Unsuitable extinguishing media None

5.2 Special hazards arising from the substance or mixture

Non-flammable. Extinguish surrounding fires using appropriate methods.

5.3 Advice for firefighters

Wear protective equipment if required for other materials within the immediate vicinity.

Section 6. Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

Avoid generation of dusty atmospheres. Do not inhale dusts. Contaminated work clothing should not be allowed out of the workplace. Use personal protective equipment as required. Wash hands, and face thoroughly after handling.

6.2 Environmental precautions

Avoid release to the environment.

6.3 Methods and material for containment and cleaning up

Pick up and replace original container. Use vacuum equipment for collecting spilt materials, where practicable.

6.4 Reference to other sections

See also sections 7 and 8.

Section 7. Handling and Storage

7.1 Precautions for safe handling

Prevent the generation of inhalable dusts e.g. by the use of suitable ventilation. Do not inhale dust. Wear appropriate nationally approved respirators if handling is likely to cause the concentration limits of airborne nickel to exceed the locally prescribed exposure limits. Wear suitable protective clothing and gloves. Contaminated work clothing should not be allowed out of the workplace.

7.2 Conditions for safe storage, including any incompatibilities

Keep in the container supplied, and keep container closed when not in use. Local regulations should be followed regarding the storage of this product.

7.3 Specific end uses

See section 1.2

Section 8. Exposure Controls / Personal Protection

8.1 Control Parameters

8.1.1 Exposure Limits:

| Nickel Oxide (NiO) – CAS 1313-99-1 | | |
|------------------------------------|-------------------------------------|------|
| | Exposure Limit (mg/m ³) | Year |
| ACGIH TLV-TWA ¹ | 0.2 * ‡ as Ni | 2008 |
| UK WEL ² | 0.5 as Ni | 2011 |
| Japan | 1 as Ni | 2012 |
| Korea | 0.1 as Ni | 2006 |
| China | 1 as Ni | 2007 |

* Inhalable fraction

‡ Insoluble inorganic fraction

8.1.2 Biological limit value

Not established

8.1.3 PNECs and DNELs

| | Unit | DNEL |
|--------------------|---------------------------|-------|
| Dermal | | |
| Long-term local | mgNi/cm ² /day | 0.035 |
| Inhalation | | |
| Acute local | mgNi/m ³ | 11.9 |
| Long-term systemic | mgNi/m ³ | 0.05 |
| Long-term local | mgNi/m ³ | 0.05 |

| Compartment | Unit | PNEC |
|-----------------------|------------------------|------|
| Freshwater | µg Ni/L (bioavailable) | 7.1 |
| Sediment (freshwater) | mg Ni/kg | 109 |
| Marine water | µg Ni/L | 8.6 |
| Sediment (marine) | mg Ni/kg | 109 |
| Agricultural soil | mg Ni/kg | 29.9 |

8.2 Exposure Controls

8.2.1 Occupational exposure controls:

Do not inhale dust. Mechanical extraction ventilation may be required if user operations change it to other physical or chemical forms, whether as end products, intermediates or fugitive emissions, which are inhalable. Maintain airborne nickel levels as low as possible. Avoid repeated skin contact.

8.2.2 Individual protection measures, such as personal protective equipment

Eye/face protection None specific, but recommended to wear eye protection.

Hand and skin protection Wear suitable protective clothing and gloves, which should be selected specifically for the working place, depending on concentration and quantity of the hazardous material. Wash skin thoroughly after handling and before eating, drinking or smoking. Change contaminated clothing frequently. Launder clothing and gloves as needed. Use of skin-protective barrier cream advised.

Respiratory protection If required, use an approved respirator with particulate filters.

Thermal hazards Not applicable

8.2.3 Environmental exposure controls

Avoid release to the environment.

Section 9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Solid, granular dark grey material.

| | |
|--------------------------------------|-------------------------------|
| Physical state at 20°C and 101.3 kPa | Solid |
| Melting / freezing point | >1900°C |
| Boiling point | Not applicable |
| Decomposition temperature | Not applicable |
| Relative density | 6.75g/cm ³ at 20°C |
| Vapour pressure | Not applicable |

| | |
|---|--|
| Vapour density | Not applicable |
| Surface tension | Not applicable |
| Water solubility | 3.52x10 ⁻⁵ g/l at 20°C (green nickel oxide) 2.26x10 ⁻³ g/l at 20°C (black nickel oxide) |
| pH | Not applicable |
| Evaporation rate | Not applicable |
| Partition coefficient n-octanol/water (log value) | Not applicable |
| Flash point | Not applicable |
| Flammability | Non-flammable |
| Explosive properties | Not applicable |
| Self-ignition temperature | >400°C |
| Oxidising properties | Non-oxidising |
| Granulometry | <0.1% of particles with a diameter <100µm |
| Stability in organic solvents and identity of relevant degradation products | Not applicable |
| Dissociation constant | Not applicable |
| Viscosity | Not applicable |
| Packaged density | See relative density |

9.2 Other information

None

[Section 10. Stability and Reactivity](#)

10.1 Reactivity

Stable under normal conditions.

10.2 Chemical stability

Stable under normal conditions.

10.3 Possibility of hazardous reactions

Stable under normal conditions.

10.4 Conditions to avoid

None

10.5 Incompatible materials

None

10.6 Hazardous decomposition products

No information available.

Section 11. Toxicological Information³

11.1 Information on toxicological effects

The toxicology of the reported components is summarized below.

Nickel Oxide

Acute toxicity

| | |
|--------------|---|
| Ingestion | LD ₅₀ ORAL RAT: >11,000 mg/kg (green); 9,990 (black) – Not classified. |
| Inhalation | LD ₅₀ INHAL RAT >5.08 mg/m ³ (green); >5.15 mg/m ³ (black) – Not classified. |
| Skin contact | Not classified. |
| Eye contact | Not classified |

Skin corrosion/irritation

Not classified

Serious eye damage/irritation

Not classified, but mildly irritating

Respiratory or skin sensitisation

Nickel oxide is currently classified as a dermal sensitizer according to the 1st ATP to the CLP Regulation. Recent studies evaluating the bioaccessibility of a series of nickel compounds in synthetic sweat indicated very low nickel ion release from nickel oxide suggesting very low or no sensitization potency. Early Guinea pig maximization and Beuhler test results show low potential for nickel oxide to act as a dermal sensitizer. Nickel oxide is not classified as a respiratory sensitiser according to the 1st ATP to the CLP Regulation.

Germ cell mutagenicity

Nickel oxide is not classified for mutagenicity according to the 1st ATP to the CLP Regulation.

Carcinogenicity

Nickel oxide is classified for carcinogenicity via inhalation (Carc. 1A:350i) according to the 1st ATP to the CLP Regulation. The most robust and environmentally relevant carcinogenicity study for NiO was conducted as part of a National Toxicology Program study (Dunnick et al 1995). The authors characterized the evidence for NiO carcinogenicity in the lungs as “equivocal”.

Reproductive toxicity

Not classified.

STOT – single exposure

Not classified.

STOT – repeated exposure

Nickel oxide is classified for repeated dose toxicity (STOT-RE 1; H372) according to the 1st ATP to the CLP Regulation. Exposure related toxicities were noted following 13 weeks and two years of exposure to nickel oxide

in both rats and mice in the US NTP chronic rat inhalation study. Adverse effects in rodents were primarily limited to the lung. The LOAEC from the chronic study in rats was 0.6 mg NiO/m³ or 0.5 mg Ni/m³

Aspiration hazard

None anticipated.

Cobaltous Oxide (CoO)

Acute toxicity

Ingestion

LD₅₀ ORAL RAT: 202 mg/kg; According to the CLP regulation CoO has an harmonized legal classification of Category 4; H302.

Inhalation

CoO has is no harmonized CLP classification. However, based on recent test work the Cobalt Institute have self-classified as Acute Tox. 2; H330.

Skin contact

Not classified.

Eye contact

Not classified

Skin corrosion/irritation

Not classified

Serious eye damage/irritation

Not classified

Respiratory or skin sensitisation

According to the EC Regulation No. 1272/2008 and subsequent regulations, the test item is classified as Category 1; H317.

CoO has no harmonized classification for respiratory sensitisation. However, the Cobalt Institute have self-classified as Category 1B; H334

Germ cell mutagenicity

Not classified.

Carcinogenicity

CoO has no harmonized CLP Classification. However, recent test-work conducted by the Cobalt Institute as shown that CoO behaves similarly to Co metal powder and Co sulphate. According to the industry grouping methodology CoO is predicted to resemble Co metal powder and Co sulphate with respect to chronic inhalation toxicity. As a result, the decision has been made to self-classify as Carc. 1B; H350i.

Reproductive toxicity

Not classified.

STOT – single exposure

Not classified.

STOT – repeated exposure

Not classified.

Aspiration hazard

None anticipated.

Copper oxide (CuO)

Acute toxicity

Ingestion LD₅₀ ORAL RAT: > 2500 mg/kg; Not classified.

Inhalation Not classified.

Skin contact Not classified.

Eye contact Not classified

Skin corrosion/irritation

Not classified.

Serious eye damage/irritation

Not classified.

Respiratory or skin sensitisation

Not classified.

Germ cell mutagenicity

Not classified.

Carcinogenicity

Not classified.

Reproductive toxicity

Not classified.

STOT – single exposure

Not classified.

STOT – repeated exposure

Not classified.

Aspiration hazard

None anticipated.

11.2 Other information

None

Section 12. Ecological Information

12.1 Toxicity

Aquatic Chronic 3. May cause long lasting harmful effects to aquatic life.

12.2 Persistence and degradability

The PBT and vPvB criteria of Annex XIII to the Regulation do not apply to inorganic substances, such as nickel oxide. The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Nickel does not tend to bioaccumulate or biomagnify in aquatic or terrestrial systems.

12.4 Mobility in soil

The substance is essentially insoluble in water.

12.5 Results of PBT and vPvB Assessment

Not classified.

12.6 Other adverse effects

None anticipated.

Section 13. Disposal Considerations

13.1 Waste treatment methods

Product

Methods of Disposal

The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction.

Hazardous Waste

The classification of the product may meet the criteria for a hazardous waste.

Packaging

Methods of disposal

Generation of waste should be avoided or minimized wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

Special precautions

Container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

13.2 Additional information

None

Section 14. Transport Information

| | ADR/RID | ADN | IMDG | IATA |
|-------------------------------------|---|---|---|---|
| 14.1 UN Number | None | None | None | None |
| 14.2 UN proper shipping name | Not applicable | Not applicable | Not applicable | Not applicable |
| 14.3 Transport classes | Not classified as dangerous for transport | Not classified as dangerous for transport | Not classified as dangerous for transport | Not classified as dangerous for transport |
| 14. Packing group | Not applicable | Not applicable | Not applicable | Not applicable |
| 14.5 Environmental hazards | Not applicable | Not applicable | Not applicable | Not applicable |

14.6 Special precautions for user

Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code

Not harmful to the marine environment (non HME)

Section 15. Regulatory Information

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

EU Regulation (EC) No. 1907/2006 (REACH)

Candidate List of SVHC for Authorisation Not listed

Annex XIV List of substances subject to Authorisation Not listed

Annex XVII List of substances subject to Restriction Not listed

Community Rolling Action Plan Not listed



REACH Registration #'s:

01-2119467172-41-XXXX – Vale Europe Limited

01-2119467172-41-XXXX – Vale Japan Limited (H2 Compliance acting as Only Representative)

15.2 Chemical Safety Assessment

Available. See Annex 1 for Exposure Scenarios.

Section 16. Other Information

Indications of change:

1.0 – Original document

1.1 – Update Only Representative for Vale Japan

1.2 - Update of identified uses and Appendix 1-Exposure Scenarios

Full text of precautionary statements

Prevention:

P201 - Obtain special instructions before use

P202 - Do not handle until all safety precautions have been read and understood

P260 - Do not breathe dust or fume

P261 - Avoid breathing dust or fume; Wear respiratory protective equipment if fine dusts are generated.

P264 - Wash hands, and face thoroughly after handling.

P270 - Do not eat, drink or smoke when using this product.

P271 – Use only outdoors or in a well-ventilated area

P272 - Contaminated work clothing should not be allowed out of the workplace.

P273 - Avoid release to the environment.

P280 - Wear protective gloves and protective clothing

P284 – [In case of inadequate ventilation] wear respiratory protection

Response:

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

P304+P340 – IF INHALED: remove person to fresh air and keep comfortable for breathing

P308+P313 - If exposed or concerned: Get medical advice/attention P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.

P314 - Get medical advice/attention if you feel unwell.

P321 - See Safety Data Sheet for specific treatment

P342+P311 – If experiencing respiratory symptoms: Call a POISON CENTER/doctor

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

Storage:

P405 - store locked up

Disposal:

501 - Dispose of contents/container in accordance to local/regional/national/international regulations

Legend

The following acronyms may be found in this document:

| | |
|------------------|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| DNEL | Derived No Effect Level |
| LD ₅₀ | Lethal dose 50% |
| LOAEC | Lowest Observed Effect Concentration |
| LTEL | Long Term Exposure Limit |
| LR | Lead Registrant |
| MMAD | Mass Median Aerodynamic Diameter |
| NIOSH | National Institute of Occupational Safety and Health |
| NTP | National Toxicity Program (US) |
| OEL | Occupational Exposure Limit |
| OR | Only Representative |
| OSHA | Occupational Safety and Health Administration |
| PBT | PBT: Persistent, Bioaccumulative and Toxic |
| PNEC | Predicted No Effect Concentration |
| STEL | Short Term Exposure Limit |
| STOT | Specific Target Organ Toxicity |
| TLV-TWA | Threshold Limit Value-Time Weighted Average |
| vPvB | Very Persistent and Very Bioaccumulative |
| WEL | Workplace Exposure Limit (UK HSE EH40) |

Safety Data Sheet prepared by:

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SDS available online at <http://www.vale.com/canada/en/business/mining/nickel/pages/default.aspx>

Note:

Vale Canada Limited believes that the information in this Safety Data Sheet is accurate. However, Vale Canada makes no express or implied warranty as to the accuracy of such information and expressly disclaims any liability resulting from reliance on such information.

1. Threshold Limit Values of the American Conference of Governmental Industrial Hygienists. 2016
2. Maximum Exposure Limit of the Health and Safety Executive in the U.K. in EH40/2005.
3. Describes possible health hazards of the product supplied. If user operations change it to other chemical forms, whether as end products, intermediates or fugitive emissions, the possible health hazards of such forms must be determined by the user.

ANNEX 1 – Exposure Scenarios

Exposure Scenarios can be obtained by clicking on the following link:

<http://www.vale.com/canada/EN/business/mining/product-safety-information/reach-scenarios-oxide/Pages/default.aspx>

If you are unable to retrieve the document or have difficulties, please contact use the following email address for assistance: msds@vale.com

ES 1: Formulation or re-packing; Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors

ES 2: Use at industrial sites; Use of nickel oxide containing catalysts

ES 3: Use at industrial sites; Use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts

ES 4: Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing powders

ES 5: Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing frits

ES 6: Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing inorganic pigments

ES 7: Use at industrial sites; Use of nickel oxide for the manufacture of nickel-containing glass

ES 8: Use at industrial sites; Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process)

ES 9: Use at industrial sites; Use of nickel oxide sinter in the production of stainless, special steels and special alloy

ES 10: Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics

ES 11: Use at industrial sites; Use of nickel oxide powder for the production of nickel zinc ferrite cores

ES 12: Service life (worker at industrial site); Service life of nickel-containing electronics/ferrite cores in industrial settings

ES 13: Service life (professional worker); Service life of nickel-containing electronics/ferrite cores in professional settings

ES 14: Use at industrial sites; Use of nickel oxide for the production of nickel oxide containing automotive catalysts

ES 15: Service life (worker at industrial site); Production of vehicle exhaust systems in industrial settings

ES 16: Service life (professional worker); Service life of vehicle exhaust systems in professional settings