

INDUSTRIAL

Reference Materials Catalogue 2024



Industrial

Enthalpy of Fusion Materials

LGC2601	Indium
LGC2603	Naphthalene
LGC2604	Benzil
LGC2605	Acetanilide
LGC2606	Benzoic acid
LGC2607	Diphenylacetic acid
LGC2608	Lead
LGC2609	Tin
LGC2610	Biphenyl
LGC2611	Zinc
LGC2612	Aluminium
LGC2613	Phenyl salicylate

Flash Point Materials

ERM-FC032	n-Nonane
ERM-FC033	n-Decane

Gypsum Materials

LGC2700	Natural gypsum
LGC2701	Natural anhydrite
LGC2702	Blended gypsum
LGC2703	Desulfurised gypsum

Melting Point Materials

ERM-FC021	Carbazole
ERM-FC022	2-Chloroanthraquinone
ERM-FC023	Anisic acid
ERM-FC024	Diphenylacetic acid
LGC2405	Benzoic acid
ERM-FC026	Acetanilide
ERM-FC027	Benzil
ERM-FC028	Naphthalene
ERM-FC029	4-Nitrotoluene
ERM-FC030	Phenyl salicylate

Industrial

Miscellaneous Materials

ERM-AC316	Solvent yellow 124
ERM-EF212	Petrol - sulfur
LGCQC5050	Colloidal gold nanoparticle - nominal diameter 30 nm

Industrial

Enthalpy of Fusion Materials

Indium LGC2601

Batch: 003
Unit size: 0.5 g

A suitable supply of indium was obtained with a nominal purity of 99.9999 mol %. The material was dispensed into units weighing > 0.5 g in amber screw-capped glass vials.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.



4005

Certified values:

Enthalpy of fusion	28.69 ± 0.09 J/g
Melting temperature	156.60 ± 0.07 °C

Naphthalene LGC2603

Batch: 002
Unit size: 0.5 g

A suitable supply of pure material was obtained and purified by zone refining. The material was dispensed as 0.5 g portions into amber glass vials.

This material is intended for the calibration of differential Scanning calorimeters and similar instruments.

Certified values:

Enthalpy of fusion	18.923 ± 0.083 kJ/mol
Melting temperature	80.25 ± 0.03 °C

Benzil LGC2604

Batch: 002
Unit size: 0.5 g

The bulk material was purified by repeated fractional freezing from the melt. It was ground and sieved to particles less or equal to 710 µm and was homogenised by tumbling and rolling on a laboratory mill. It was then sub-divided, by riffing, into a number of sub-fractions. From those sub-fractions, 0.5 g aliquots were transferred into amber glass vials.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:

Enthalpy of fusion	23.26 ± 0.10 kJ/mol
Melting temperature	94.85 ± 0.02 °C

Acetanilide
LGC2605

Batch: 005
Unit size: 0.5 g

A suitable supply of pure material was obtained. The material was dispensed as 0.5 g portions into amber glass vials. Differential scanning calorimetry (DSC) and adiabatic calorimetry were used to assess the purity of the material; the measured mole fraction of purity was 99.98 % and 99.996 % respectively.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:	
Enthalpy of fusion	21.793 ± 0.085 kJ/mol
Melting temperature	114.34 ± 0.02 °C

Benzoic acid
LGC2606

Batch: 002
Unit size: 0.5 g

The bulk material was purified by repeated fractional freezing from the melt. It was ground and sieved to particles less than or equal to 710 µm and was homogenised by tumbling and rolling on a laboratory mill. It was then sub-divided, by riffing, into a number of sub-fractions. From those sub-fractions, 0.5 g aliquots were transferred into amber glass vials.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:	
Enthalpy of fusion	17.98 ± 0.04 kJ/mol
Melting temperature	122.35 ± 0.03 °C

Diphenylacetic acid
LGC2607

Batch: 006
Unit size: 0.5 g

A suitable supply of pure material was obtained. It was dispensed as 0.5 g portions into amber glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.98 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:	
Enthalpy of fusion	31.16 ± 0.13 kJ/mol
Melting temperature	147.19 ± 0.03 °C

Lead
LGC2608

Batch: 001
Unit size: 0.5 g

A suitable supply of pure material was obtained. The material was dispensed as 0.5 g portions into amber glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.9995 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:	
Enthalpy of fusion	4.765 ± 0.012 kJ/mol
Melting temperature	327.47 ± 0.02 °C

Tin
LGC2609

Batch: 002
Unit size: 0.5 g

A suitable supply of tin, with a nominal purity of 99.9999 %, was obtained from a commercial supplier in pellet form. The material was dispensed into units weighing > 0.5 g in amber screw-capped glass vials, with each vial containing 3 – 4 pellets.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.



4005

Certified values:

Enthalpy of fusion	60.27 ± 0.16 J/g
Melting temperature	231.93 ± 0.08 °C

Biphenyl
LGC2610

Batch: 001
Unit size: 0.5 g

A suitable supply of biphenyl was obtained and purified by repeated fractional freezing from the melt. The purified material was ground and sieved to a particle size of ≤ 710 μm and was homogenised by tumbling and rolling on a laboratory mill. The material was sub-sampled as 0.5 g portion into amber-glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.992 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:

Enthalpy of fusion	18.60 ± 0.11 kJ/mol
Melting temperature	68.93 ± 0.02 °C

Zinc
LGC2611

Batch: 001
Unit size: 0.5 g

A suitable supply of pure material was obtained. The material was dispensed as 0.5 g portions into amber glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.9998 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:

Enthalpy of fusion	7.103 ± 0.034 kJ/mol
Melting temperature	419.53 ± 0.02 °C

Aluminium
LGC2612

Batch: 001
Unit size: 0.5 g

A suitable supply of pure material was obtained. The material was dispensed as 0.5 g portions into amber glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.9995 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:

Enthalpy of fusion	10.827 ± 0.052 kJ/mol
Melting temperature	660.33 ± 0.05 °C

Phenyl Salicylate
LGC2613

Batch: 001
Unit size: 0.5 g

A commercial supply of phenyl salicylate was obtained and purified by fractional crystallisation. The purified material was ground to pass a 710 μm sieve, dried under vacuum and then dispensed as 0.5 g portions into amber glass vials. The purity of the material was assessed by adiabatic calorimetry; the measured mole fraction was 99.994 %.

This material is intended for the calibration of differential scanning calorimeters and similar instruments.

Certified values:	
Enthalpy of fusion	19.18 ± 0.08 kJ/mol
Melting temperature	41.79 ± 0.03 °C

Flash Point Materials

n-Nonane ERM-FC032

Batch: a
Unit size: 100 mL

A supply of n-nonane, of nominally 99 % purity, was obtained from a commercial supplier. 100 mL portions of this solution were sub-sampled into amber glass bottles fitted with PTFE-coated chlorobutyl septa and aluminium tear seals.

This material is intended for use in validation work, or in quality control procedures, for the determination of non-equilibrium flashpoint determined by the Abel closed cup method as described in the Institute of Petroleum Standard IP170/95, and also published as British Standard BS2000:Part 170:1995.



4005

Certified values:	
Non-equilibrium flashpoint	32.5 ± 0.5 °C

n-Decane ERM-FC033

Batch: a
Unit size: 100 mL

A supply of n-decane, of nominally 99 % purity, was obtained from a commercial supplier. 100 mL portions of this solution were sub-sampled into amber glass bottles fitted with PTFE-coated chlorobutyl septa and aluminium tear seals.

This material is intended for use in validation work, or in quality control procedures, for the determination of non-equilibrium flashpoint determined by the Abel closed cup method as described in the Institute of Petroleum Standard IP170/95, and also published as British Standard BS2000: Part 170:1995.



4005

Certified values:	
Non-equilibrium flashpoint	50.0 ± 0.9 °C

Gypsum Materials

Natural gypsum – major oxides and trace elements LGC2700

Batch: 001
Unit size: 75 g

Natural gypsum, in the form of small chippings, was obtained from British Gypsum (East Leake, Leicestershire, UK). The material was prepared using a jaw crusher fitted with hardened chromium steel jaws to provide a powder, nominally 3 mm maximum diameter. The crushed material was dried at 30 °C in a calibrated drying oven. After drying, the material was milled until the powder passed a calibrated 75 µm stainless steel sieve mesh. The material was sub-sampled in aliquots of approximately 75 g into screw capped amber glass bottles.



4005

This reference material is intended for use in the validation of new methods, and for monitoring the performance of methods commonly used in laboratories to analyse samples of gypsum for quality control and environmental monitoring purposes.

Assessed values:	
Aluminium (as Al ₂ O ₃)	2.872 ± 0.056 g/100 g
Calcium (as CaO)	26.31 ± 0.36 g/100 g
Iron (as Fe ₂ O ₃)	1.150 ± 0.062 g/100 g
Phosphorus (as P ₂ O ₅)	0.0367 ± 0.0052 g/100 g
Potassium (as K ₂ O)	0.830 ± 0.024 g/100 g
Silicon (as SiO ₂)	10.93 ± 0.22 g/100 g
Sodium (as Na ₂ O)	0.183 ± 0.018 g/100 g
Sulfur (as SO ₃)	34.67 ± 0.60 g/100 g
Titanium (as TiO ₂)	0.1480 ± 0.0075 g/100 g
Loss on ignition	19.78 ± 0.71 g/100 g
Nickel	9.5 ± 2.0 mg/kg
Vanadium	21.3 ± 3.2 mg/kg
Zinc	19.3 ± 3.8 mg/kg

Indicative values:	
Magnesium (as MgO)	3.2 g/100 g
Manganese (as MnO)	0.030 g/100 g
Strontium (as SrO)	0.20 g/100 g
Arsenic	2.4 mg/kg
Barium	170 mg/kg
Chromium	15 mg/kg
Copper	5.0 mg/kg
Lead	4.2 mg/kg
Thallium	0.18 mg/kg
Mercury	< 2 µg/kg

**Natural anhydrite – major oxides and trace elements
LGC2701**

Batch: 001
Unit size: 75 g

Anhydrite, in the form of coarse chippings, was obtained from British Gypsum (East Leake, Leicestershire, UK). The material was prepared using a jaw crusher fitted with hardened chromium steel jaws to provide a powder, nominally 3 mm maximum diameter. The crushed material was dried at 30 °C in a calibrated drying oven. After drying, the material was ball-milled until the powder passed a calibrated 75 µm stainless steel sieve mesh. The material was sub-sampled in aliquots of approximately 75 g into screw capped amber glass bottles.



4005

This reference material is intended for use in the validation of new methods, and for monitoring the performance of methods commonly used in laboratories to analyse samples of gypsum for quality control and environmental monitoring purposes.

Assessed values:	
Aluminium (as Al ₂ O ₃)	0.045 ± 0.029 g/100 g
Calcium (as CaO)	40.82 ± 0.67 g/100 g
Iron (as Fe ₂ O ₃)	0.0280 ± 0.0096 g/100 g
Phosphorus (as P ₂ O ₅)	0.0069 ± 0.0040 g/100 g
Potassium (as K ₂ O)	0.0105 ± 0.0050 g/100 g
Silicon (as SiO ₂)	0.112 ± 0.044 g/100 g
Sulfur (as SO ₃)	57.8 ± 1.2 g/100 g
Loss on Ignition	0.452 ± 0.093 g/100 g

Indicative values:	
Magnesium (as MgO)	0.080 g/100 g
Manganese (as MnO)	0.0025 g/100 g
Sodium (as Na ₂ O)	0.023 g/100 g
Strontium (as SrO)	0.18 g/100 g
Titanium (as TiO ₂)	0.0066 g/100 g
Arsenic	0.16 mg/kg
Chromium	4.4 mg/kg
Cobalt	0.35 mg/kg
Copper	3.5 mg/kg
Lead	1.6 mg/kg
Nickel	1.9 mg/kg
Vanadium	2.6 mg/kg
Zinc	1.6 mg/kg
Mercury	< 3 µg/kg

**Blended gypsum – major oxides and trace elements
LGC2702**

Batch: 001
Unit size: 75 g

Blended gypsum, in the form of chippings and powders, was obtained from British Gypsum (East Leake, Leicestershire, UK). The material was dried at 30 °C in a calibrated drying oven, then ball-milled in a cleaned 250 mL capacity agate milling vessel until the powder passed a calibrated 75 µm stainless steel sieve mesh. The material was sub-sampled in aliquots of approximately 75 g into screw capped amber glass bottles.



4005

This reference material is intended for use in the validation of new methods, and for monitoring the performance of methods commonly used in laboratories to analyse samples of gypsum for quality control and environmental monitoring purposes.

Certified value:	
Mercury	420 ± 35 µg/kg

Assessed values:	
Aluminium (as Al ₂ O ₃)	1.121 ± 0.038 g/100 g
Calcium (as CaO)	31.47 ± 0.65 g/100 g
Iron (as Fe ₂ O ₃)	0.392 ± 0.036 g/100 g
Phosphorus (as P ₂ O ₅)	0.0177 ± 0.0079 g/100 g
Potassium (as K ₂ O)	0.196 ± 0.013 g/100 g
Silicon (as SiO ₂)	3.01 ± 0.12 g/100 g
Sulfur (as SO ₃)	41.26 ± 0.69 g/100 g
Titanium (as TiO ₂)	0.0550 ± 0.0049 g/100 g
Loss on ignition	21.32 ± 0.21 g/100 g
Lead	8.4 ± 2.1 mg/kg
Nickel	4.8 ± 1.4 mg/kg
Vanadium	10.5 ± 1.5 mg/kg
Zinc	11.7 ± 3.1 mg/kg

Indicative values:	
Magnesium (as MgO)	0.92 g/100 g
Manganese (as MnO)	0.011 g/100 g
Sodium (as Na ₂ O)	0.031 g/100 g
Strontium (as SrO)	0.13 g/100 g
Arsenic	2.4 mg/kg
Barium	43 mg/kg
Chromium	9.0 mg/kg
Cobalt	1.8 mg/kg
Copper	4.4 mg/kg
Selenium	5.1 mg/kg
Thallium	0.18 mg/kg

**Desulfurised gypsum –
major oxides and trace
elements
LGC2703**

Batch: 001
Unit size: 75 g

Desulfurised (DSG) gypsum, in powder form, was obtained from British Gypsum (East Leake, Leicestershire, UK). The material was dried at 30 °C in a calibrated drying oven. After drying the material was ball-milled in a cleaned 250 mL capacity agate milling vessel until the powder passed a calibrated 75 µm stainless steel sieve mesh. The material was sub-sampled in aliquots of approximately 75 g into screw capped amber glass bottles.



4005

This reference material is intended for use in the validation of new methods, and monitoring the performance of methods commonly used in laboratories to analyse samples of gypsum for quality control and environmental monitoring purposes.

Certified value:	
Mercury	646 ± 42 µg/kg

Assessed values:	
Aluminium (as Al ₂ O ₃)	0.459 ± 0.031 g/100 g
Calcium (as CaO)	32.45 ± 0.86 g/100 g
Iron (as Fe ₂ O ₃)	0.142 ± 0.023 g/100 g
Phosphorus (as P ₂ O ₅)	0.0120 ± 0.0042 g/100 g
Potassium (as K ₂ O)	0.0340 ± 0.0075 g/100 g
Silicon (as SiO ₂)	0.90 ± 0.12 g/100 g
Sulfur (as SO ₃)	44.84 ± 0.55 g/100 g
Titanium (as TiO ₂)	0.0325 ± 0.0046 g/100 g
Loss on ignition	21.21 ± 0.35 g/100 g
Nickel	3.2 ± 1.3 mg/kg
Vanadium	6.0 ± 1.8 mg/kg
Zinc	9.5 ± 2.0 mg/kg

Indicative values:	
Magnesium (as MgO)	0.16 g/100 g
Manganese (as MnO)	0.0040 g/100 g
Sodium (as Na ₂ O)	0.022 g/100 g
Strontium (as SrO)	0.012 g/100 g
Arsenic	3.5 mg/kg
Chromium	7.9 mg/kg
Cobalt	0.92 mg/kg
Copper	2.8 mg/kg
Lead	3.6 mg/kg
Selenium	11 mg/kg
Thallium	0.076 mg/kg

Melting Point Materials

Carbazole ERM-FC021

Batch: a
Unit size: 0.25 g

A batch of carbazole was obtained from a commercial source and then purified by recrystallisation and vacuum sublimation. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.88 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.

Certified value:

Liquefaction point 245.41 ± 0.29 °C



4005



0423

2-Chloroanthraquinone ERM-FC022

Batch: a
Unit size: 0.25 g

A batch of 2-chloroanthraquinone was obtained from a commercial source then purified by recrystallisation, dried under vacuum, ground to pass a 710 µm sieve and mixed. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.72 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.

Certified value:

Liquefaction point 209.73 ± 0.24 °C



4005



0423

Anisic acid ERM-FC023

Batch: a
Unit size: 0.25 g

A batch of anisic acid was obtained from a commercial source, ground to pass through a 710 µm sieve, mixed and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.97 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.

Certified value:

Liquefaction point 183.50 ± 0.31 °C



4005



0423

Diphenylacetic acid ERM-FC024

Batch: a
Unit size: 0.25 g

A batch of diphenylacetic acid was obtained from a commercial source, ground to pass through a 710 µm sieve, mixed and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.96 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.

Certified value:

Liquefaction point 147.26 ± 0.31 °C



4005



0423

**Benzoic acid
LGC2405**

Batch: 007
Unit size: 0.25 g

A batch of benzoic acid, obtained from a commercial source, was ultra-purified by fractional crystallisation. The material was ground to pass through a 710 µm sieve, homogenised by rolling and tumbling, and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.97 mol %. The identity of benzoic acid was confirmed by qualitative NMR.

The primary use of this reference material is in calibrating and checking apparatus used for the determining melting points of samples in glass capillary tubes.



4005

Certified value:

Liquefaction point 122.35 ± 0.12 °C

**Acetanilide
ERM-FC026**

Batch: a
Unit size: 0.25 g

A batch of acetanilide, obtained from a commercial source, was ground to pass through 710 µm sieve, mixed and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.95 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.



4005



0423

Certified value:

Liquefaction point 114.19 ± 0.28 °C

**Benzil
ERM-FC027**

Batch: a
Unit size: 0.25 g

A batch of benzil was obtained from a commercial source, ground to pass through a 710 µm sieve, mixed and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.96 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.



4005



0423

Certified value:

Liquefaction point 94.90 ± 0.24 °C

**Naphthalene
ERM-FC028**

Batch: a
Unit size: 0.25 g

A batch of naphthalene was obtained from a commercial source, ground to pass a 710 µm sieve, mixed and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.92 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.



4005



0423

Certified value:

Liquefaction point 80.34 ± 0.22 °C

4-Nitrotoluene
ERM-FC029

Batch: a
Unit size: 0.25 g

A batch of 4-nitrotoluene, obtained from a commercial source, was purified by fractional crystallisation. The material was ground to pass through a 710 µm sieve, homogenised by rolling and tumbling, and dried. The purity of the material was checked using differential scanning calorimetry (DSC) and found to be 99.93 mol %.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.



4005



0423

Certified value:

Liquefaction point 51.66 ± 0.18 °C

Phenyl salicylate
ERM-FC030

Batch: a
Unit size: 0.25 g

A batch of phenyl salicylate was obtained from a commercial source. The purity of the material was assessed using HPLC and found to be (99.92 + 0.08/ - 0.4) mass % at the 95 % confidence level. This was confirmed by DSC. The identity was confirmed by NMR. The water content was assessed using Karl Fischer Titration and residual solvents using TGA.

This material is intended for use in checking and calibrating apparatus used for the determination of melting points of samples in glass capillary tubes.



4005



0423

Certified value:

Liquefaction point 41.82 ± 0.30 °C

Miscellaneous Materials

**Solvent Yellow 124
(SY 124)
ERM-AC316**

Batch: a
Unit size: 0.2 g

A batch of Solvent Yellow 124 (SY124) was obtained from a commercial source and purified by column chromatography. The purified material was homogenised in propan-2-ol by stirring for 2 hours at room temperature. The solvent was subsequently removed by evaporation using a rotary evaporator and its purity was determined by HPLC-UV and GC-FID.

This material is intended for use as an analytical standard for the determination of SY124 in fuel.

Certified value:	
Purity	95.0 ± 1.2 mass %

**Petrol – sulfur
ERM-EF212**

Batch: a
Unit size: 19 mL

This material is a petroleum product containing sulfur in its natural forms, closely matching commercial petrol fuels. The absence of artificially added sulfur species avoids any effects arising from species specific analytical methods. A suitable supply of petrol was obtained in bulk from BP Oil International. The material was dispensed into 19 mL portions into clear borosilicate glass ampoules.

This material is intended for use in the development, validation or quality control of analytical methods for the determination of sulfur in petrol. The material may also be applicable to other similar matrices and procedures where more clearly matched reference materials are not available.

Certified value:	
Sulfur	20.2 ± 1.1 mg/kg



4005

**Colloidal gold
nanoparticle - nominal
diameter
30 nm
LGCQC5050**

Batch: 001
Unit size: 5.2 mL

The starting material was a commercially prepared solution consisting of colloidal spherical gold nanoparticles (citrate stabilised) with average diameter of approximately 30 nm, suspended in water. After careful mixing, the solution was dispensed into amber glass ampoules in 5.2 mL portions and sealed under argon. The filled units were irradiated for sterilisation purposes using Co⁶⁰ gamma irradiation at a minimum dose of 35 kGy. Approximately 500 units were prepared and stored at (5 ± 4) °C.

This Quality Control material is intended, primarily, to evaluate and qualify methodology and/or instrument performance related to the number-based characterisation of nanoscale particles, including particle concentration and diameter. The indicative values are not suitable for establishing method bias and metrological traceability.

Assessed value:	
Number particle concentration	(1.47 x 10 ¹¹) ± (2.8 x 10 ¹⁰) NP/g

Indicative values:	
Particle modal diameter	32.7 ± 2.0 nm
Gold mass fraction	45.1 ± 1.5 mg/kg



www.lgcgroup.com/nml

measurement@lgcgroup.com

+44 (0)20 8943 7393 • LGC Queens Road,
Teddington, Middlesex, TW11 0LY, UK

