

Crucibles and Fluxes for Inorganic Oxygen, Nitrogen, and Hydrogen Determination

LECO® DH603, RHEN602, 736, and 836 Instrument Series

LECO Corporation; Saint Joseph, Michigan USA

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Note: Click on an instrument, crucible, or flux to view specific information regarding that instrument, crucible, or flux and its use*.

* When navigating this document using a hyperlink, you may return to your previous location by pressing: Alt+left arrow key

Crucibles and Fluxes for Inorganic Oxygen, Nitrogen, and Hydrogen Determination

	DH603	RHEN602	O736	N736	ON736	O836	O836Si	N836	H836	ON836	OH836	NH836	ONH836
Crucibles													
619-895 – High Temperature Crucibles (EN Systems)		X											
764-330 – Standard Crucibles (EN Systems)		X											
776-247 – Standard Crucibles			X	X	X	X		X	X	X	X	X	X
782-703 – Large Outer Crucible							X						
782-720 – High Temperature Crucibles			X	X	X	X		X	X	X	X	X	X
782-720S – Large High Temperature Crucibles			X	X	X	X		X	X	X	X	X	X
782-720HD – Large High Density Crucibles			X	X	X	X	X	X	X	X	X	X	X
782-795HD – High Density Inner Crucibles							X						
Fluxes													
501-059 – Small Tin Capsules			X		X*	X			X	X*	X	X*	X*
501-073 – Graphite Powder			X	X	X	X		X	X	X	X	X	X
501-598 – Nibbled Nickel Flux			X	X	X	X		X	X	X	X	X	X
502-040 – Large Tin Capsules			X		X*	X			X	X*	X	X*	X*
502-344 – Nickel Basket, Ultra High Purity (1 g each)			X	X	X	X		X	X	X	X	X	X
502-345 – Nickel Basket, Ultra High Purity (1.5 g each)			X	X	X	X		X	X	X	X	X	X
502-822 – Nickel Capsule (< 100mg of refractory materials)			X	X	X	X		X	X	X	X	X	X
761-739 – Tin Flux, for O/N/H determination (0.5 g pellets)			X		X*	X			X	X*	X	X*	X*
764-242 – Tin Flux, for O/N/H determination (0.2 g pellets)			X		X*	X			X	X*	X	X*	X*

*Not recommended for nitrogen determination.

Note: Click on an instrument, crucible, or flux to view specific information regarding that instrument, crucible, or flux and its use.**

** When navigating this document using a hyperlink, you may return to your previous location by pressing: Alt+left arrow key

Instruments

Hot Extraction Instrument

Includes: DH603

► Hydrogen Determination



DH603

Applicable Crucibles and Fluxes:

- No crucibles or fluxes are required for hydrogen determination on the DH603

Applicable Accessories:

- **Evacuated Steel Sampler with Inner Steel Pin**
 - 903-9A3-184 – 3-foot Cardboard, 6-inch Non-Splash Sleeve with Anti-Skull Coat
 - 903-9A3-194 – 3-foot Cardboard, 12-inch Non-Splash Sleeve with Anti-Skull Coat
- **Evacuated Steel Sampler with Quartz Lining**
 - 903-9B3-184 – 3-foot Cardboard, 6-inch Non-Splash Sleeve with Anti-Skull Coat
 - 903-9B3-194 – 3-foot Cardboard, 12-inch Non-Splash Sleeve with Anti-Skull Coat
- **Evacuated Pin Tubes for Rapid Sampling of Molten Metals**
 - 511-036-150 – Standard Pin Tube: 4 mm ± 0.2 mm (0.159" ± 0.009 ") ID x ~146 mm (5.75") L
 - 511-039-150 – Standard Pin Tube: 3.5 mm ± 0.2 mm (0.39" ± 0.009 ") ID x ~146 mm (5.75") L
 - 511-037-150 – Precision Pin Tube: 4 mm ± 0.025 mm (0.159" ± 0.001 ") ID x ~146 mm (5.75") L
 - 511-244 – High Vacuum Tube: 6 mm (0.236") ID x 125 mm (4.92") L

Applicable Matrices and Elemental Determination*:

- [Steel Samples](#) (Hydrogen)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this group of instruments. It is not a comprehensive list of all possible applicable matrices.*

Instruments

Impulse Furnace Instruments (Inert Gas Fusion (IGF) Instruments) (RHEN602, 736, and 836 Instrument Series)

Includes: RHEN602, O736, N736, ON736, O836, O836Si, N836, H836, ON836, OH836, NH836, and ONH836

► Oxygen, Nitrogen, and Hydrogen Determination



RHEN602



ON736



ONH836

Applicable Crucibles:

- [619-895 – High Temperature Crucibles \(EN Systems\)](#)
- [764-330 – Standard Crucibles \(EN Systems\)](#)
- [776-247 – Standard Crucibles](#)
- [782-703 – Large Outer Crucible](#)
- [782-720 – High Temperature Crucibles](#)
- [782-720S – Large High Temperature Crucibles](#)
- [782-720HD – Large High-Density Crucibles](#)
- [782-795HD – High Density Inner Crucibles](#)

Note: Click on a crucible above for additional details regarding that crucible and its recommended use.

Applicable Fluxes:

- [501-059 – Small Tin Capsules](#)
- [501-073 – Graphite Powder](#)
- [501-598 – Nibbled Nickel Flux](#)
- [502-040 – Large Tin Capsules](#)
- [502-344 – Nickel Basket, Ultra High Purity \(1 g each\)](#)
- [502-345 – Nickel Basket, Ultra High Purity \(1.5 g each\)](#)
- [502-822 – Nickel Capsule](#)
- [761-739 – Tin Flux, for O/N/H determination \(0.5 g pellets\)](#)
- [764-242 – Tin Flux, for O/N/H determination \(0.2 g pellets\)](#)

Note: Click on a flux above for additional details regarding that flux and its recommended use.

Instruments

Impulse Furnace Instruments (IGF Instruments Cont...)

(RHEN602, 736, and 836 Instrument Series)

Includes: RHEN602, O736, N736, ON736, O836, O836Si, N836, H836, ON836, OH836, NH836, and ONH836

Applicable Matrices and Elemental Determination*:

- [Tin and Lead-Based Solder Powders \(Oxygen\)](#)
- [Solid Iron, Steel, Nickel-Base, and Cobalt-Base Alloys \(Oxygen and Nitrogen\)](#)
- [Refractory Metals and their Alloys, Solid Samples \(Oxygen and Nitrogen\)](#)
- [Refractory Metals and their Alloys, Powder/Chip Samples \(Oxygen and Nitrogen\)](#)
- [Reactive and Refractory Metals \(Hydrogen\)](#)
- [Aluminum \(Oxygen\)](#)
- [Copper and Copper Alloys \(Oxygen\)](#)
- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)
- [Titanium Hydride \(Oxygen and Hydrogen\)](#)
- [Iron, Steel, Nickel-Base, and Cobalt-Base Alloys \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Refractory Metals \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Silicon Wafers \(Oxygen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this group of instruments. It is not a comprehensive list of all possible applicable matrices.*

Crucibles

High Temperature Crucible for EN Systems (619-895)

Applicable Instrument(s): RHEN602 (Inert Gas Fusion Instrument)



Considerations:

- Designed primarily for hydrogen determination in steel and refractory materials
- Can be used for hydrogen determination in aluminum and copper
- Requires 619-896 Lower Electrode Tip

Applicable Sample Matrices and Elemental Determination*:

- [Copper and Copper Alloys \(Hydrogen\)](#)
- [Reactive and Refractory Metals \(Hydrogen\)](#)
- [Steel and Iron \(Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Standard Crucible for EN Systems (764-330)

Applicable Instrument(s): RHEN602 (Inert Gas Fusion Instrument)



Considerations:

- RHEN Crucible designed primarily for hydrogen determination in aluminum and aluminum alloys
- Can be used for hydrogen determination in steel and copper alloys
- Requires a 611-351-183 Lower Electrode Tip (manual) or 611-351-180 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Aluminum and Aluminum Alloys \(Hydrogen\)](#)
- [Copper and Copper Alloys \(Hydrogen\)](#)
- [Steel and Iron \(Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Standard Crucible (776-247)

Applicable Instrument(s): O736, N736, ON736, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Standard crucible designed primarily for analysis of steel
- Can be used for analysis of nonferrous and refractory materials
- Requires 611-351-182 Lower Electrode Tip (manual) or 611-351-181 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Tin and Lead Based Solder Powders \(Oxygen\)](#)
- [Solid Iron, Steel, Nickel-Base, and Cobalt-Base Alloys \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Aluminum \(Oxygen\)](#)
- [Copper and Copper Alloys \(Oxygen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Large Outer Crucible (782-703)

Applicable Instrument(s): O836Si



Considerations:

- Large, outer “heater” HP graphite crucible primarily designed for oxygen determination in silicon
- Used in conjunction with 782-795HD Inner graphite crucibles
- Can be reused for up to 20 replicates (inner crucible should be replaced for each replicate)
- Requires 611-351-182 Lower Electrode Tip (manual) or 611-351-181 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Silicon Wafers \(Oxygen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

High Temperature Crucible (782-720)

Applicable Instrument(s): O736, N736, ON736, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- High temperature crucible designed for analysis of refractory materials (Such as: titanium, zirconium, tantalum, tungsten, and high temp nickel/cobalt alloys)
- Requires 782-721 Lower Electrode Tip (manual) or 618-376 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Refractory Metals and their Alloys \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Reactive and Refractory Metals \(Hydrogen\)](#)
- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)
- [Titanium Hydride \(Oxygen and Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Large High Temperature Crucible (782-720S)

Applicable Instrument(s): O736, N736, ON736, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Large volume crucible primarily designed for analysis of powder ferrous metals, where a larger sample mass is required.
- Requires 782-721 Lower Electrode Tip (manual) or 618-376 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)
- [Copper and Copper Alloys \(Oxygen Only\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Large High-Density Crucible (782-720HD)

Applicable Instrument(s): O736, N736, ON736, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Large volume crucible primarily designed for analysis of powder ferrous metals where larger sample masses are required
- Requires 782-721 Lower Electrode Tip (manual) or 618-376 Lower Electrode Tip (autoloader)

Applicable Sample Matrices and Elemental Determination*:

- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)
- [Copper and Copper Alloys \(Oxygen Only\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

High-Density Inner Crucible (782-795HD)

Applicable Instrument(s): O836Si



Considerations:

- Inner graphite crucible primarily designed for oxygen determination in silicon
- Used in conjunction with 782-703 Large Outer Graphite Crucible

Applicable Sample Matrices and Elemental Determination*:

- [Silicon Wafers \(Oxygen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucible and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this crucible. It is not a comprehensive list of all possible applicable matrices.*

Fluxes

Certain materials may require a flux to assure adequate recovery of oxygen and nitrogen. The flux can also be used to encapsulate powder samples, which may or may not require a flux for proper analyte recoveries, in order to facilitate the use of the autoloader (such as nickel baskets or capsules). LECO supplies a variety of high purity fluxes for use in inert gas fusion instruments. Following is a description of the most commonly used flux materials supplied by LECO.

Small Tin Capsule (501-059)

Applicable Instrument(s): O736, ON73, O836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Used for analysis of powder and granular samples with a small particle size
- Can be used in conjunction with 502-344 UHP Nickel Baskets for analysis of refractory materials
- Primarily used for oxygen and hydrogen determination
- Not recommended for nitrogen-only determination

Applicable Sample Matrices and Elemental Determination*:

- [Copper and Copper Alloys \(Hydrogen\)](#)
- [Reactive and Refractory Metals \(Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Graphite Powder (501-073)

Applicable Instrument(s): O736, N836, ON73, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Used to improve analyte recovery in refractory materials, particularly for nitrogen determination
- Typical applications involve the addition of ~50 mg of graphite powder to the graphite crucible prior to initiation of analysis.
- Graphite powder prevents the sample and flux from pooling at the bottom of the crucible.
- Failure to use graphite powder, when analyzing refractory materials, and some stainless-steel alloys, can cause a doming effect (refer to picture below) which reduces analyte recovery for all elements.



Applicable Sample Matrices and Elemental Determination*:

- [Tin and Lead Based Solder Powders \(Oxygen\)](#)
- [Refractory Metals and their Alloys \(Oxygen and Nitrogen\)](#)
- [Copper and Copper Alloys \(Oxygen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Nibbled Nickel Flux (501-598)

Applicable Instrument(s): O736, N836, ON73, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Ultra-high purity nibbled nickel
- Use (~0.4 g) in conjunction with 502-822 Nickel Capsules for analysis of powder/granular refractory metals
- Primarily designed to meet the flux-to-sample requirements of ASTM E1409

Applicable Sample Matrices and Elemental Determination*:

- [Refractory Metals and their Alloys \(Oxygen, Nitrogen and Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Large Tin Capsule (502-040)

Applicable Instrument(s): RHEN602, O736, ON73, O836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Used for analysis of powder and granular samples with small particle sizes
- Typically used for the analysis of iron/steel/nickel/cobalt powders where analysis of a larger sample mass is required
- Primarily used for oxygen and hydrogen determination
- Not recommended for nitrogen-only determination

Applicable Sample Matrices and Elemental Determination*:

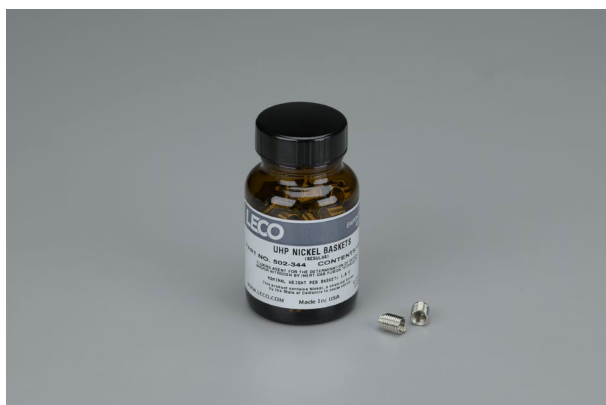
- [Reactive and Refractory Metals \(Hydrogen\)](#)
- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Nickel Basket, Ultra High Purity (1.0 g each) (502-344)

Applicable Instrument(s): O736, N836, ON73, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Ultra-high purity nickel basket used for ultra-low oxygen and nitrogen determination when optimum precision is required
- Primarily designed for use in refractory metal applications, when analyzing sample masses of ~0.1 g (designed to meet the flux-to-sample requirements of ASTM E1409)
- Used in combination with 782-720 High Temperature Crucibles

Applicable Sample Matrices and Elemental Determination*:

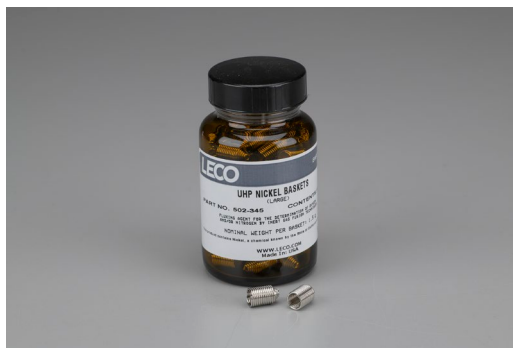
- [Refractory Metals \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Refractory Metals and their Alloys \(Oxygen and Nitrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Nickel Basket, Ultra High Purity (1.5 g each) (502-345)

Applicable Instrument(s): O736, N836, ON73, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Primarily designed for use in refractory applications, when analyzing sample masses of ~0.15 g (required to meet flux-to-sample requirements of ASTM E1409)
- Used in combination with 782-720 High Temperature Crucibles

Applicable Sample Matrices and Elemental Determination*:

- [Refractory Metals \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Refractory Metals and their Alloys \(Oxygen and Nitrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Nickel Capsule (502-822)

Applicable Instrument(s): O736, N836, ON73, O836, N836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Primarily designed for analysis of powder and granular samples with small particle sizes
- Can be used for steel/iron/nickel/cobalt applications and refractory metal applications
- Requires the use of ~0.4 g of 501-598 Nibbled Nickel for refractory metal applications
- Can be used with 776-247 or 782-720 crucibles (or equivalent) depending upon the sample matrix

Applicable Sample Matrices and Elemental Determination*:

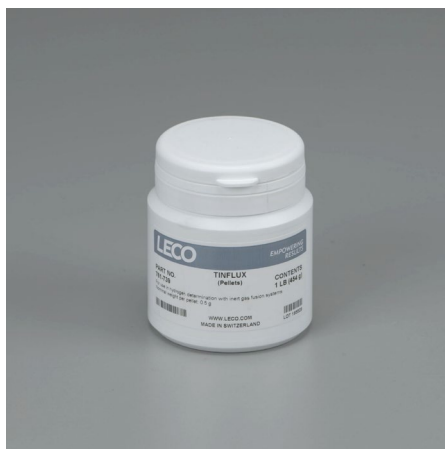
- [Solid Iron, Steel, Nickel-Base, and Cobalt-Base Alloys \(Chip or Powder Samples\) \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Refractory Metals and their Alloys \(Oxygen, Nitrogen, and Hydrogen\)](#)
- [Titanium Hydride \(Oxygen and Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Tin Flux (0.5 g Pellets) (761-739)

Applicable Instrument(s): RHEN602, O736, ON73, O836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Tin Pellets (~0.5 g), used as a “molten bath” material for metals requiring low temperature analysis
- May be used in conjunction with ~0.5 g of 501-263 Copper Chip
- Not recommended for nitrogen-only determination.

Applicable Sample Matrices and Elemental Determination*:

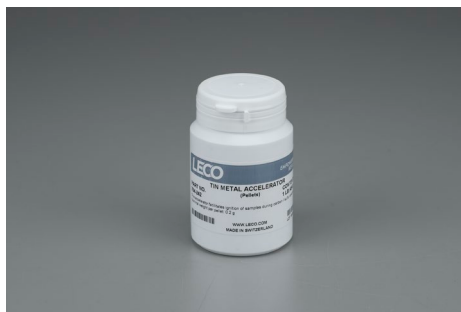
- [Reactive and Refractory Metals \(Hydrogen\)](#)
- [Aluminum \(Oxygen\)](#)
- [Copper and Copper Alloys \(Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Tin Flux (0.2 g Pellets) (764-242)

Applicable Instrument(s): O736, ON73, O836, H836, ON836, OH836, NH836, and ONH836



Considerations:

- Tin Pellets (~0.2 g) used for simultaneous oxygen and hydrogen determination in copper and copper alloys.
- Used in conjunction with 782-720S Graphite Crucibles
- Not recommended for nitrogen-only determination.

Applicable Sample Matrices and Elemental Determination*:

- [Copper and Copper Alloys \(Oxygen and Hydrogen\)](#)

Note: Click on a matrix above for additional details regarding the method and recommended crucibles and fluxes.

**This list includes some of the typical matrices (and associated elemental determination) applicable to this flux. It is not a comprehensive list of all possible applicable matrices.*

Applicable Matrices and Elemental Determination

Tin and Lead Based Solder Powders (Oxygen Determination)

Applicable Instrument(s): 736/836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [776-247 Graphite Crucible](#)
- [501-059 Small Tin Capsule](#) or [502-040 Large Tin Capsule](#)
- [501-073 Graphite Powder](#)

Considerations:

- When powder samples are to be analyzed, they cannot be placed directly in the loading head. Samples should be weighed into an open tin capsule (using clean tweezers only; do not use fingers)
- Requires the use of 611-351-181 Lower Electrode Tip (autoloader)

Note: For additional details regarding this application/method, please refer to LECO Application Note "Oxygen Determination in Tin and Lead Based Solder Powders," Form No. 203-821-563 (ON736).

Iron, Steel, Nickel, and Cobalt-Base Alloys (Oxygen, Nitrogen and Hydrogen Determination)

Applicable Instrument(s): RHEN602, 736/836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [776-247 Graphite Crucible](#) (736/836 Series)
- [502-822 Nickel Capsule](#) (for chip/powder samples) (736/836 Series)
- [764-330](#) or [619-895](#) Graphite Crucible (RHEN602)
- [761-739 Tin Pellets](#) (RHEN602)
- [501-059](#) or [502-040](#) Tin Capsules (RHEN602)
- [501-073 Graphite Powder](#) (may be required for some stainless steel samples)

Considerations:

- ASTM Test Method E1019, "Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Inert Gas Fusion Techniques," is applicable to the 736 and 836 instrument series.
- Surface contamination must be removed from solid samples prior to analysis by filing or lightly grinding the sample, then rinsing with acetone and drying with warm air. Following sample preparation, samples should be handled using clean tweezers only; do not use fingers.
- ASTM E1806 and ISO 14284 are sampling/sample preparation methods specific for steel and iron and are excellent sources of information.
- When powder or chip samples are to be analyzed, they cannot be placed directly in the loading head. Samples should be weighed into an open tin capsule (using clean tweezers only; do not use fingers)
- Requires the use of 611-351-182 Lower Electrode Tip (manual), or 611-351-181 Lower Electrode Tip (autoloader)
- When analyzing some stainless-steel alloys, a doming effect may occur which can reduce analyte recovery for all elements. The addition of ~ 50 mg of 501-073 Graphite Powder can help to reduce this effect.

Note: For additional details regarding this application/method, please refer to the following LECO Application Notes:

- "Oxygen and Nitrogen in Solid Iron, Steel, Nickel-Base, and Cobalt-Base Alloys," Form No. 203-821-527 (ON736)
- "Determination of Oxygen, Nitrogen, and Hydrogen in Iron, Steel, Nickel-Base, and Cobalt-Base Alloys: Comparison of Analytical Performance Between Argon and Helium Carrier," Form No. 203-821-601 (ONH836)
- "Determination of Oxygen, Nitrogen, and Hydrogen in Iron, Steel, Nickel-Base, and Cobalt-Base Alloys: Optimizing Cycle Time and Analytical Performance," Form No. 203-821-424 (ONH836)
- "Hydrogen Determination in Steel and Iron," Form No. 203-821-271 (RHEN602)

Refractory Metals and their Alloys (Oxygen, Nitrogen, and Hydrogen Determination)

Applicable Instrument(s): 736/836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [782-720 Graphite Crucible](#)
- [502-344 Nickel Basket](#) (Solid Samples)
- [502-822 Nickel Capsule](#) (Powder/Chip Samples)
- [501-598 Nibbled Nickel Flux](#) (Powder/Chip Samples)
- [501-073 Graphite Powder](#)

Considerations:

- ASTM Test Method E1409, "Standard Test Method for Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique," is applicable to the 736 and 836 instrument series.
- ASTM Test Method E1447, "Standard Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method," is applicable to the 836 instrument series.
- ASTM Test Method E1569, "Standard Test Method for Determination of Oxygen in Tantalum Powder by Inert Gas Fusion Technique," is applicable to the 736 and 836 instrument series.
- Surface contamination must be removed from solid samples prior to analysis. Typically, titanium samples are chemically etched to remove surface contamination for oxygen and nitrogen determination. However, ASTM Test Method E1409 permits the use of either chemical etching or abrading (filing) of titanium test specimens.
- Other refractory metals, such as zirconium, molybdenum, tantalum, niobium, rhenium, and hafnium are typically abraded, rinsed with a solvent such as acetone, and dried with warm air. Care must be taken to remove all traces of the solvent prior to analysis.
- For porous materials, such as tungsten, it is advisable to avoid the use of solvents as it can be difficult to remove all traces of the solvent by drying.
- Following sample preparation, samples should be handled using clean tweezers only; do not use fingers.
- Chip samples are typically rinsed with a solvent such as acetone, provided the sample is not porous.
- Powder samples are typically analyzed without additional preparation.
- When powder or chip samples are to be analyzed, they cannot be placed directly in the loading head. Samples should be weighed into an open 502-822 Nickel Capsule (using clean tweezers only; do not use fingers)
- Requires the use of 782-721 Lower Electrode Tip (manual), and 618-376 Lower Electrode Tip (auto-loader)

Note: For additional details regarding this application/method, please refer to the following LECO Application Notes:

- "Oxygen and Nitrogen Determination in Refractory Metals and their Alloys," Form No. 203-821-550 (ON736)
- "Oxygen, Nitrogen, and Hydrogen in Refractory Metals," Form No. 203-821-427 (ONH836)

Reactive and Refractory Metals (Hydrogen Determination)

Applicable Instrument(s): RHEN602 and 836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [782-720 Graphite Crucible](#) (836 Series)
- [764-330](#) or [619-895](#) Graphite Crucible (RHEN602)
- [501-059 Small Tin Capsule](#) or [502-040 Large Tin Capsule](#) (Powder, Chip, and Granular Samples)
- [761-739 Tin Flux Pellets](#)

Considerations:

- ASTM Test Method E1447, "Standard Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method," is applicable to the RHEN602 and the 836 instrument series.
- Surface contamination must be removed from solid samples prior to analysis. Typically, samples are abraded (filed), rinsed in a solvent such as acetone and dried with warm air prior to analysis in order to remove surface contamination. Following sample preparation, samples should be handled using clean tweezers only; do not use fingers.
- When powder, chip, or granular samples are to be analyzed, they cannot be placed directly in the loading head. Samples should be weighed into an open tin capsule (using clean tweezers only; do not use fingers)
- Requires the use of 782-721 Lower Electrode Tip

Note: For additional details regarding this application/method, please refer to the following LECO Application Notes:

- "Hydrogen in Reactive and Refractory Metals," Form No. 203-821-456 (ONH836)
- "Hydrogen Determination in Reactive and Refractory Metals," Form No. 203-821-340 (RHEN602)

Aluminum and Aluminum Alloys (Oxygen and Hydrogen Determination)

Applicable Instrument(s): RHEN602 and 836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [776-247 Graphite Crucible](#) (736/836 Series)
- [764-330 Graphite Crucible](#) (RHEN602)
- 501-263 Copper Chip (Oxygen Determination)
- [761-739 Tin Flux Pellets](#) (Oxygen Determination)

Considerations:

- Typically, samples are solid metal samples, and surface contamination should be removed prior to analysis. Samples should be sectioned with a water-cooled cut-off saw, machined on a lathe, rinsed with a solvent such as acetone, and dried with warm air. Following sample preparation, samples should be handled using clean tweezers only; do not use fingers.
- Samples should be analyzed immediately following sample preparation to avoid surface contamination or the formation of surface oxides.
- Due to the possible formation of surface oxides, the use of an autoloader is not recommended.
- Aluminum powder, chip, or granular samples can be analyzed following the method used for reactive/refractory metal chips and powders (outlined on the previous page).
- Requires the use of 611-351-182 Lower Electrode Tip (manual)

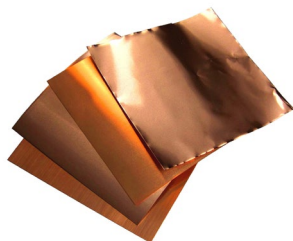
Note: For additional details regarding this application/method, please refer to the following LECO Application Notes:

- "Oxygen Determination in Aluminum," Form No. 203-821-459 (ONH836)
- "Hydrogen Determination in Aluminum and Aluminum Alloys," Form No. 203-821-300 (RHEN602)

[Click here](#) to view a video outlining the procedure for proper Aluminum Sample Preparation

Copper and Copper Alloys (Oxygen and Hydrogen Determination)

Applicable Instrument(s): RHEN602, 736, and 836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [776-247 Graphite Crucible](#) (736/836 Series, Oxygen-only Determination)
- [782-720S Graphite Crucible](#) (836 Series, Oxygen and Hydrogen Determination)
- [764-330](#) or [619-895](#) Graphite Crucible (RHEN602)
- [501-059 Small Tin Capsules](#) or [502-040 Large Tin Capsules](#) (Oxygen and Hydrogen Determination, Powder/Granular Samples)
- [501-073 Graphite Powder](#) (736/836 Series, Oxygen Determination)
- [764-242 Tin Pellets](#) (836 Series, Oxygen and Hydrogen Determination)
- [761-739 Tin Pellets](#) (RHEN602, Powder, Chip, or Granular Samples)

Considerations:

- ASTM Test Method E2575, "Standard Test Method for Determination of Oxygen in Copper and Copper Alloys by Inert Gas Fusion," is applicable to the 736 and 836 instrument series.
- ASTM E2575 requires the use of chemical etching to remove surface contamination from solid copper samples. Samples are then rinsed with a solvent such as acetone and dried with warm air.
- If conformance to ASTM E2575 is **not** required, samples may be abraded to remove surface contamination. Care must be taken to not overheat the sample and change the chemistry of the copper. Samples are then rinsed with a solvent such as acetone and dried with warm air.
- Samples should be analyzed immediately following sample preparation in order to minimize the oxidation of the sample.
- Oxygen determination on the 736 instrument series requires the use 611-351-182 Lower Electrode Tip (manual), or 611-351-181 Lower Electrode Tip (autoloader).
- Oxygen and hydrogen determination on the OH836/ONH836 requires the use of the 782-721 Lower Electrode Tip for the 782-720S Crucible (manual) or the 618-376 Lower Electrode Tip (autoloader)

Note: For additional details regarding this application/method, please refer to the following LECO Application Notes:

- "Oxygen in Copper and Copper Alloys," Form No. 203-821-436 (O836)
- "Oxygen and Hydrogen in Copper and Copper Alloys," Form No. 203-821-455 (OH836, ONH836)
- "Hydrogen Determination in Copper and Copper Alloys," Form No. 203-821-305 (RHEN602)

Titanium Hydride (Oxygen and Hydrogen Determination)

Applicable Instrument(s): 836 Series (Impulse Furnaces)



Applicable Crucibles and Fluxes:

- [782-720 Graphite Crucible](#)
- [502-822 Nickel Capsule](#)

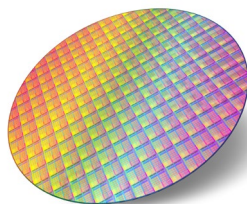
Considerations:

- Samples should be a uniform powder or chip.
- When powder or chip samples are to be analyzed, they cannot be placed directly in the loading head. Samples should be weighed into an open tin capsule (using clean tweezers only; do not use fingers)
- Requires the use of 782-721 Lower Electrode Tip (manual) or 618-376 Lower Electrode Tip (autoloader)

Note: For additional details regarding this application/method, please refer to LECO Application Note "Oxygen and Hydrogen Determination in Titanium Hydride," Form No. 203-821-458 (ONH836)

Silicon Wafers (Oxygen Determination)

Applicable Instrument(s): O836Si



Applicable Crucibles and Fluxes:

- [782-703 Large Outer Graphite Crucible](#)
- [782-795HD High Density Inner Graphite Crucible](#)

Considerations:

- Proper preparation and handling of solid silicon samples is critical. For details regarding proper sample preparation and handling, refer to the application note indicated below.
- Requires 611-351-182 Lower Electrode Tip (manual) or 611-351-181 Lower Electrode Tip (autoloader)

Note: For additional details regarding this application/method, please refer to LECO Application Note, "Determination of Oxygen in Silicon Wafers," Form No. 203-821-599 (O836Si)

Steel (Hydrogen Determination)

Applicable Instrument(s): DH603



Applicable Crucibles and Fluxes:

- No crucibles or fluxes are required for the DH603

Applicable Accessories:

- **Evacuated Steel Sampler with Inner Steel Pin**
 - 903-9A3-184 – 3-foot Cardboard, 6-inch Non-Splash Sleeve with Anti-Skull Coat
 - 903-9A3-194 – 3-foot Cardboard, 12-inch Non-Splash Sleeve with Anti-Skull Coat
- **Evacuated Steel Sampler with Quartz Lining**
 - 903-9B3-184 – 3-foot Cardboard, 6-inch Non-Splash Sleeve with Anti-Skull Coat
 - 903-9B3-194 – 3-foot Cardboard, 12-inch Non-Splash Sleeve with Anti-Skull Coat
- **Evacuated Pin Tubes for Rapid Sampling of Molten Metals**
 - 511-036-150 – Standard Pin Tube: 4 mm ± 0.2 mm (0.159" ± 0.009 ") ID x ~146 mm (5.75") L
 - 511-039-150 – Standard Pin Tube: 3.5 mm ± 0.2 mm (0.39" ± 0.009 ") ID x ~146 mm (5.75") L
 - 511-037-150 – Precision Pin Tube: 4 mm ± 0.025 mm (0.159" ± 0.001 ") ID x ~146 mm (5.75") L
 - 511-244 – High Vacuum Tube: 6 mm (0.236") ID x 125 mm (4.92") L

Considerations:

- The push rod will need to be burned-off prior to analysis. For details regarding this procedure, refer to the Application Note listed below, and the DH603 Operator's Instruction Manual.

Note: For additional details regarding this application/method, please refer to LECO Application Note, "Hydrogen in Steel Samples," Form No. 203-821-376 (DH603)