MONITORING HF IN ALUMINIUM SMELTERS

- Meet regulatory requirements
- Use measurements to manage and reduce HF emissions
- Lower capital and operational costs

boreal-laser.com  REMOTE PRECISION. SURE DECISION.
ROOF-LINE MONITORING
GasFinder2-MC - “High Range”

WHY THIS IS NEEDED
- While some of the gaseous HF emissions are scrubbed and removed by the GTC, the bulk of the smelters fugitive emissions are from pot room activities
- Most environmental protection agencies around the world require some level of HF monitoring in the roofline of a smelter to determine the amount of fugitive HF emissions
- Performance of pot room activities can be measured and managed to minimize both gaseous and particulate emissions

HOW IT WORKS
- Boreal’s OP-TDL (Laser) technology counts every HF gas molecule in the measurement path to give a path integrated ppm-m concentration, which then can be converted to user specific mass per volume units
- The OP-TDL mounted in the roofline of a pot room has the ability to quantitatively measure all the gases below the active measurement path which is typically 300-600m long
- Measure only the target gas and all of the target gas. Boreal analyzers do not suffer from cross interference and are not confused by other gases present or affected by humidity
- Real-time HF measurements can be broadcast on a scoreboard for pot room operators to see how their actions effect emissions

GENERATE A MASS FLOW RATE
- If your smelter or local environmental protection agency requires you to report a mass flow rate this can be done
- What you will need to generate a mass flow rate is the path integrated concentration (ppm-m) and wind direction and speed data from a 3D sonic anemometer
- With these collected data you can generate an estimated mass flow rate

TYPICAL CONFIGURATION
- GasFinder2-MC or GF2-MC (Multi-Channel) is the best technical and economical configuration for high temperature rooflines (GasFinder2-OP’s may be used in cool climates)
- The integrated cabinet with the analyzer, communication modules, and data logger/historian is typically installed in an environmentally controlled electrical room
- Fibre optic cabling carries the laser light from the analyzer to the Open Path Measurement Heads and laser light returned from the retro-reflector is collected on the photo-diode in the open path head and the electronic signal is carried back to the analyzer via coaxial cable
- The Open Path Measurement Head (OP3 Heads), which can operate in temperatures as high as 80°C, are mounted in the centre of the pot room, which increases the spatial resolution to two distinct zones in the roofline

MOUNTING + ALIGNMENT
- OP-TDLs utilize a mono-static configuration (transceiver & retro-reflector) which saves on capital costs by only requiring power and communication cables at one end of the measurement path
- The best mounting structures for the transceiver (analyser or measurement heads) have been supported and affixed to multiple girders to avoid head alignment issues caused by changing ambient temperatures and sunlight exposure
- This diurnal movement typically causes the laser “dot” to move off of the retro-reflector in a diagonal (primarily vertical) fashion
- This can be rectified by having two (or three) smaller retro boxes placed along the laser “dots” diagonal path
- The retro-reflectors will return the laser back at the exact same angle from which it entered and it makes the retro less susceptible to vibration and does not require as sturdy as a mount as the transceiver side

BENEFITS OF OP-TDL
- Large spatial coverage and one second temporal resolution
- Long Life Span: systems built over 20-years ago still in operation today
- No interference with other gases
- No memory effects
- HF gas cannot poison or damage the laser light
- Data collection and interpretation is simple and intuitive
- Built for high temperature applications
- Internal Reference Cell: minimizes drift and need for intervention
- Sophisticated self-diagnostics of data quality
- Can provide an independent sample or reading every second
- Free and unlimited phone and email support

REQUIRED COMPONENTS
- GF2-MC + MODULES
- INTEGRATED CABINET
- DIAGNOSTIC KIT
- OPEN PATH HEADS
- DUST ENCLOSURES
- RETRO-REFLECTORS

12846-146 Street NW, Edmonton, AB, CA T5L 2H7  P +1.780.488.5173  F +1.780.488.0880  E info@borealLaser.com  W boreal-laser.com
REMOTE PRECISION. SURE DECISION.
WHY THIS IS NEEDED

• The roofline installation gives you a cumulative measurement over the pot room but **not identify where the problematic “hot spots” are located**
• With this tool the performance of **pot room activities can be directly measured and managed at the source** to minimize both gaseous and particulate emissions
• This is a very valuable tool to educate operators **how small changes and improvements can add up to a large reduction** in fugitive HF emissions

HOW IT WORKS

• Boreal’s OP-TDL (Laser) technology **counts every HF gas molecule** in the active measurement path to give a path integrated ppm-m concentration, which then can be converted to user specific mass per volume units
• The portable OP-TDL mounted in various locations in the pot room has the ability to **quantify the HF concentration in the active measurement path**
• **Measure only the target gas and all of the target gas**. Boreal analyzers do not suffer from cross interference and are not confused by other gases present or are affected by humidity

RENTAL CONFIGURATION

RENTAL SYSTEMS AVAILABLE

• Not all smelters have the budget available to purchase a piece of analytical instrumentation that is only used for temporary campaigns
• Boreal Laser has an **inventory of analyzers and accessories available for rent in one month intervals**

REQUIRED COMPONENTS

TYPICAL POT ROOM ACTIVITIES

• Ensuring **proper hood cover placement**
• Measuring HF levels during activities **while the pot is open**
• Measuring **activities that occur outside of the pot**
• Observing efficiencies of the use of the **high draft system**
• Monitoring in **anode cooling room, bath crushing, and rodding room**

BENEFITS OF OP-TDL

• **Easy to transport, set-up, and use**
• Large **spatial coverage** and one second **temporal resolution**
• **No interference** with other gases
• **No memory effects**
• HF gas **cannot poison** or damage the laser light
• **Data collection and interpretation** is simple and intuitive
• **Internal Reference Cell**: minimizes drift and need for intervention
• Sophisticated **self-diagnostics** of data quality
• Can provide **an independent sample or reading every second**
• **Free and unlimited** phone and email support

SYSTEM PORTABILITY

• All-in-one field mounted analyzer
• The **rugged industrial enclosure** can be mounted on a portable tripod, fixed pedestal, or on a tilt-pan scanner
• Can be set-up and **collecting data in minutes**
• The low power requirements of the analyzer enable it to be powered by **deep cycle batteries and/or with solar panels**
• **Wireless communication** is possible through optional modules
INLET DUCT MONITORING
GasFinder2-MC - “High Range”

WHY THIS IS NEEDED
• The HF concentration in the inlet duct of the GTC is a leading indicator of pot performance (pot gas recovery and top heat balance)
• Provides feedforward measurements to control and react to higher inlet HF concentrations before stack emissions increase to unacceptable levels
• These measurements provide knowledge of whether high stack emissions are due to issues within the pot room, the GTC, or both

WHAT IT DOES
• The duct probe is an engineered solution for our series of GasFinder analyzers to remotely monitor the path average concentration inside of the GTC baghouse compartments

HOW IT WORKS
• The GasFinder2-MC can be mounted locally or remotely
• Fibre optic cable carries the laser light from the analyzer to the remotely mounted duct probe (transceiver)
• The active measurement path is formed by the laser passing through the baghouse compartment and being returned by the retroreflector on the opposing flange.
• The laser light is then collected and the signal is carried back to the analyzer via coaxial cable
• The ppm-m concentration is then transferred from the analyzer to the PLC or DCS

AIR PURGE
• In some cases, condensation and accumulated dust can cause optical interference or a blocked path.
• For cases of positive pressure, instrument air can be tubed in to the spacer flange to provide a flow rate of 1-5 l/min to keep the dust from settling
• In instances of negative pressure, the ¼” NPT port in the spacer flange can be left open to allow air circulation

OPTICAL ALIGNMENT
• Install the transceiver and leave the retro flange off
• Remove cover plate on the transceiver
• Connect the visible laser from the troubleshooting and diagnostic kit (most stacks and ducts have a particulate load and the beam should easily be seen)
• Adjust the alignment screws so the visible laser beam is aimed through the opposing flange port
• Install the retro flange, remove the visible laser, and replace the cover plate on the transceiver

CONSIDERATIONS
• It is important that the flanges are welded orthogonally to the duct and that the two flanges are mounted at the same height
• For high concentration applications, we can configure the probe to be “pitch-catch” (transmitter and receiver) to only allow a single pass for the laser
• For high concentration installations, a plenum can be used to reduce the active measurement path to minimize the effects of signal saturation and alumina dust obstruction
• For duct temperatures over 120°C (250°F), it is recommended to install a spacer between the duct probe and flange

BENEFITS OF OP-TDL
• Large spatial coverage and one second temporal resolution
• Long Life Span: systems built over 20-years-ago still in operation today
• No interference with other gases
• No memory effects
• HF gas cannot poison or damage the laser light
• Data collection and interpretation is simple and intuitive
• Built for high temperature applications
• Internal Reference Cell: minimizes drift and need for intervention
• Sophisticated self-diagnostics of data quality
• Can provide an independent sample or reading every second
• Free and unlimited phone and email support

REQUIRED COMPONENTS
GF2-MC + MODULES INTEGRATED CABINET DUCT PROBE
BAGHOUSE MONITORING
GasFinder2-MC - “Low Range”

WHY THIS IS NEEDED
• Increased production or tightening emission regulations may require increased HF scrubbing capacity
• Rather than undergoing a large capital expense to design and build a wet-scrubbing system it may make more sense to maximize your dry-scrubbers capabilities
• HF concentrations in the stack are often the result of one bad filter compartment and by using OP-TDLs (Lasers) to actively measure each of the baghouse compartments your GTC may find enough operational improvements to reduce your overall stack emissions to negate the installation of the wet-scrubber

WHAT IT DOES
• The duct probe is an engineered solution for our series of GasFinder analyzers to remotely monitor the path average concentration inside of the GTC baghouse compartments
• This data allows GTC operations to optimize the recycle rate and fresh alumina distribution to minimize the HF emissions
• By making direct measurements within each baghouse, operations now knows how each compartments functions

HOW IT WORKS
• The GasFinder2-MC can be mounted locally or remotely
• Fibre optic cable carries the laser light from the analyzer to the remotely mounted duct probe (transceiver)
• The active measurement path is formed by the laser passing through the baghouse compartment and being returned by the retroreflector on the opposing flange.
• The laser light is then collected and the signal is carried back to the analyzer via coaxial cable
• The ppm-m concentration is then transferred from the analyzer to the PLC or DCS

AIR PURGE
• In some cases, condensation and accumulated dust can cause optical interference or a blocked path.
• For cases of positive pressure, instrument air can be tubed in to the spacer flange to provide a flow rate of 1-5 l/min to keep the duct from settling.
• In instances of negative pressure, the ¼” NPT port in the spacer flange can be left open to allow air circulation

CONSIDERATIONS
• It is important that the flanges are welded orthogonally to the duct and that the two flanges are mounted at the same height.
• For duct temperatures over 120°C (250°F), it is recommended to install a spacer between the duct probe and flange

OPTICAL ALIGNMENT
• Install the transceiver and leave the retro flange off
• Remove cover plate on the transceiver
• Connect the visible laser from the troubleshooting and diagnostic kit (most stacks and ducts have a particulate load and the beam should easily be seen)
• Adjust the alignment screws so the visible laser beam is aimed through the opposing flange port
• Install the retro flange, remove the visible laser, and replace the cover plate on the transceiver

SCHEMATIC

BENEFITS OF OP-TDL
• Large spatial coverage and one second temporal resolution
• Long Life Span: systems built over 20-years ago still in operation today.
• No interference with other gases
• No memory effects
• HF gas cannot poison or damage the laser light
• Data collection and interpretation is simple and intuitive
• Built for high temperature applications
• Internal Reference Cell: minimizes drift and need for intervention
• Sophisticated self-diagnostics of data quality
• Can provide an independent sample or reading every second
• Free and unlimited phone and email support

REQUIRED COMPONENTS

GF2-MC + MODULES INTEGRATED CABINET DUCT PROBE
STACK MONITORING
GasFinder2-FCr - “Low Range”

WHY THIS IS NEEDED
- Local environmental protection agencies may require your smelter to continuously monitor for HF emissions from the stack as a condition for your operating permit

WHAT IT DOES
- The probe is an engineered solution for our series of GasFinder analyzers to remotely monitor the path average concentration inside of the stack
- Unlike some stack monitoring vendors, Boreal Laser does not mount the analytical electronics directly on the stack as the high ambient and stack temperatures reduces the measurement accuracy and significantly reduces the lifespan of the analyzer
- Boreal Laser has a patented internal reference cell that does not require routine intervention or zero/span gas to eliminate drift as this is done automatically once a minute

HOW IT WORKS
- The GasFinder2-FCr can be mounted locally or remotely
- Fibre optic cable carries the laser light from the analyzer to the remotely mounted stack/duct probe (transceiver)
- The active measurement path is formed by the laser passing through the stack/duct and being returned by the retroreflector on the opposing flange.
- The laser light is then collected and the signal is carried back to the analyzer via coaxial cable
- The ppm-m concentration is then transferred from the analyzer to the PLC or DCS

SCHEMATIC

CONSIDERATIONS
- It is important that the flanges are welded orthogonally to the duct and that the two flanges are mounted at the same height
- For stack temperatures over 120°C (250°F), it is recommended to install a spacer flange

OPTICAL ALIGNMENT
- Install the transceiver and leave the retro flange off
- Remove cover plate on the transceiver
- Connect the visible laser from the troubleshooting and diagnostic kit (most stacks and ducts have a particulate load and the beam should easily be seen)
- Adjust the alignment screws so the visible laser beam is aimed through the opposing flange port
- Install the retro flange, remove the visible laser, and replace the cover plate on the transceiver
- Alignment optimization can be done while system is in operation and without any special tools

AIR PURGE
- In some cases, condensation and accumulated dust can cause optical interference or a blocked path.
- Since the electronic are mounted remotely, the system is fail-safe as the air purge is not a critical component to keep the electronic cool
- For cases of positive pressure, instrument air can be tubed in to the spacer flange to provide a flow rate of 1-5 l/min to keep the dust from settling
- In instances of negative pressure, the ¼” NPT port in the spacer flange can be left open to allow air circulation

BENEFITS OF OP-TDL
- Large spatial coverage and one second temporal resolution
- Long Life Span: systems built over 20-years-ago still in operation today
- No interference with other gases
- No memory effects
- HF gas cannot poison or damage the laser light
- Data collection and interpretation is simple and intuitive
- Built for high temperature applications
- Internal Reference Cell: minimizes drift and need for intervention
- Sophisticated self-diagnostics of data quality
- Can provide an independent sample or reading every second
- Free and unlimited phone and email support

REQUIRED COMPONENTS

GF2-MC + MODULES INTEGRATED CABINET DUCT PROBE
OTHER SERVICES + OPTIONS PROVIDED

SHORT-TERM EQUIP. RENTAL
• For short-term and non-routine measurement campaigns there may not be available capital money to purchase and maintain analytical instrumentation
• GasFinder2-OP and GasFinder2-FC (with stack/duct probe) rentals for the are available on a monthly basis

LONG-TERM EQUIP. LEASE
• While you may have the need for continuous monitoring in your smelter, you may not have the capital budget to purchase this equipment but have operational funds available.
• Equipment leases are available on a yearly basis
• Routine factory calibration, check-ups, upgrades, and repairs of the analyzers are included in the lease

INSTALL + COMMISSION
• Project Management services available throughout installation
• Boreal engineers will commission the installation and ensure the system functioning and running properly

FACTORY/ON-SITE TRAINING
• Training is available at the Boreal Factory or available on-site
• A Training Certificate is available
• Boreal Engineers are available for on-site commissioning support

PM CONTRACT + SITE VISITS
• Boreal’s recommended service interval is every 2 years
• PM contacts are available for yearly sight visits and biennial service on the analyzer (calibration and check-up)
• Contracts are available for quarterly site visits to perform quality assurance checks on the installation (other frequencies are also available)
• Preventative maintenance and any other required alterations/upgrades will be done to ensure optimal performance of the installation

REMOTE SERVICE CONTRACT
• Service contracts are available for Boreal Laser to remotely monitor the performance of the installation
• If the system requires intervention then Boreal engineers can remotely interact with the system to regain optimal performance (if appropriate equipment is installed)

QUARTERLY DATA REVIEW
• Four times a year an engineer from Boreal Laser’s support team will review your collected data to ensure the system is functioning properly and optimally

CALIBRATIONS + UPGRADES
• While Boreal Laser does not have a mandatory calibration frequency, it is “recommended” to have your system calibrated every two years
• While your system is back for calibration there are often opportunities to perform upgrades to either the systems hardware or analysis algorithms that were not available during manufacturing or the last calibration

HOT SPARE RENTAL
• With the service ‘hot spare’ rental you are able to send your analyzer back to the factory for calibration, check-up and updates without interrupting your ability to make measurements
• Changing-out the analyzer is an easy plug & play process
• We can program the rental analyzer to have the same configuration as your system
• Have peace-of-mind knowing that your analyzer is properly maintained

HOT SPARE SHIPPING
• The ‘hot-spare’ analyzer is shipped in a custom case
• The shipping information/payment is already included in the rental crate
• Insert your analyzer in the crate and ship back to the factory

HOT SPARE RENTAL TERMS
• Rental duration is for remainder of calibration and check-up
• Return the rental analyzer when you receive your analyzer back
• There is a flat rental fee for this service