

Safe Thermal Oxidation of Hydrogen-Rich Battery Anode Process Emissions

Vianode AS, Norway

Case Study

Key facts:

Industry:

Lithium-ion Battery Materials

Location:

Norway

Technology:

- 500 Nm³/h Direct-Fired Thermal Oxidiser (TO)
- 10,000 Nm³/h Rotary Regenerative Thermal Oxidiser (RTO)

Process Streams:

- Calcination furnace exhaust
- Granulation and reactor exhaust

Key Pollutants:

- Hydrogen
- Methane
- Pitch fumes
- Benzene
- Organic compounds

Special Features:

- Nitrogen purging
- Cyclone pre-treatment
- Static mixing scrubber
- Emergency carbon adsorption system
- ATEX and CE compliance

The Solution:

Vianode required an emissions control solution for its lithium battery anode material production facility in Norway.

“The Vianode project demonstrates how advanced thermal oxidation technology can safely manage hydrogen-rich battery process emissions while maintaining operational reliability and environmental compliance.”

The manufacturing process generated two separate process exhaust streams containing high concentrations of hydrogen, methane and organic compounds, together with sticky pitch fumes that presented significant operational and safety challenges. The calcination process generated hot exhaust gases at approximately 400°C with hydrogen concentrations exceeding 15% by volume. The waste gas also contained pitch fumes and condensable compounds that could lead to fouling and blockage of downstream equipment. The granulation and reactor processes generated additional emissions containing hydrogen, methane and asphalt fumes. These gases required careful management to ensure safe operation while maintaining effective VOC destruction.

The project also required compliance with European CE standards, ATEX requirements and operation within Norway's challenging climatic conditions.

Safety features

The system incorporates several layers of process safety, including:

- Nitrogen purging systems.
- Emergency shut-off valves.
- Emergency bypass systems.
- Explosion protection measures.
- Continuous concentration monitoring.
- Carbon adsorption emergency treatment.
- Low oxygen operation.
- Static suppression through water mist.

These features allow safe treatment of hydrogen-rich process gases while maintaining reliable operation.



System performance

- 10,000 m³/h RTO treatment capacity.
- 500 Nm³/h dedicated TO system.
- Thermal efficiency greater than 95%.
- Residence time greater than 1.2 seconds.
- Operating temperatures of 760 – 850°C.
- RTO pressure drop below 4,000 Pa.
- Cold start time below two hours.
- Designed for operation from -30°C to +40°C.



System performance

The integrated TO and RTO system provides safe and reliable treatment of challenging battery material process emissions.

Cyclone pre-treatment reduces fouling risks associated with pitch fumes and condensable compounds, while the static mixing scrubber ensures safe dilution of combustible gases before entering the RTO.

The installation delivers effective destruction of VOCs and combustible compounds while meeting stringent environmental and safety requirements for modern battery material production. The project demonstrates the application of advanced thermal oxidation technology within the rapidly expanding lithium-ion battery manufacturing sector.

Project highlights

- Hydrogen-rich waste gas treatment.
- Integrated TO and RTO technology.
- Pitch fume management.
- Nitrogen purge safety systems.
- Static suppression technology.
- Emergency carbon adsorption.
- ATEX compliant design.
- Nordic climate operation.



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