VESDA & LI-ION TAMER

SOLUTIONS FOR GIGAFACTORIES

COMBINE WORLD-LEADING TECHNOLOGY WITH LOW TOTAL COST OF OWNERSHIP TO ENSURE THE BEST FIRE PROTECTION FOR GIGAFACTORIES.

- MANUFACTURING SPACE

- DATA ROOMS

- HVDC SWITCHGEAR/ PROCESS CONTROL

- CELL/ MODULE ASSEMBLY

- EOL PREP/ QA TESTING/ BATTERY STORAGE

OVERVIEW

The word Gigafactory was coined by Elon Musk in 2013 when describing the battery production plant Tesla was building in Nevada USA. That site was "really, really big" and during its planning, Musk said that rising demand for EVs would require more similar-sized 'giga factories' in the future.

Gigafactories are now defined as specialised ultra-large volume production facilities for the manufacturing of lithium-ion (li-ion) batteries for EV's and Battery Energy Storage Systems (BESS).

According to a September 2021 analysis by CIC EnergiGUNE, there are over 20 gigafactories currently planned in Europe by 2030.

Aside from being very large, complex buildings requiring advanced smoke detection solutions, these production facilities represent unique safety challenges during and after the manufacturing processes, partly due to the chemical nature of the li-ion battery cells.

Xtralis can offer a unique combination of its award-winning VESDA smoke detection products and the unrivalled Li-ion Tamer Electrolyte Vapour Detection System – an "off-gas" sensor that pinpoints faulty batteries and ensures non-interrupted production.

THE BEST & EARLIEST DETECTION IN ALL ENVIRONMENTS

RISKS

Gigafactories have a significant fire risk due to the highly complex manufacturing processes required in battery production. National and local codes dictate smoke detection requirements addressed by VESDA for EN:54-20 Class A, B & or C compliance.

However, there are currently unconsidered dangers in lithium-ion production, storage, transport, and installation that are not yet covered by codes and standards. Recent li-ion fires have encouraged the adoption of electrolyte vapour detection requirements in cities throughout the United States - most recently in Austin, Texas. Many other cities in the States and abroad are following Austin's example and asset owners will be expected to make retroactive changes to their fire prevention designs to include electrolyte vapour detection in the near future.

Processes that benefit from Li-ion Tamer detection include*:

- Formation
- Degassing
- HT Aging
- NT Aging
- EOL Testing
- Storage

CONSEQUENCES OF GIGAFACTORY FIRES

- Loss of life and staff injuries
- Total loss of expensive manufacturing equipment, raw materials, and finished goods (batteries)
- Service disruption and downtime revenue loss
- Incalculable reputational damage

OBJECTIVES

- Provide early warning of potential electrolyte solvent vapour, smoke, and fire threats to ensure staff safety, operational continuity, and asset protection
- Eliminate threat and cost of nuisance alarms
- Benefit from lower installation and maintenance costs in high ceiling spaces and high security environments, combined with off-site control and remote verification
- Pinpoint the location of a compromised battery at the earliest opportunity

* Details taken from RWTH Aachen University/VDMA Paper - LI-ION BATTERY CELL PRODUCTION PROCESS

THE GIGAFACTORY BUILDING

The Challenge – Smoke and fire in large volume/high ceiling hi-tech manufacturing buildings are very unwelcome. The often intricate and convoluted nature of these buildings do not lend themselves to 'normal' smoke detection solutions. Maintenance access also needs to consider – both from a safety & operational point of view – to ensure business continuity.
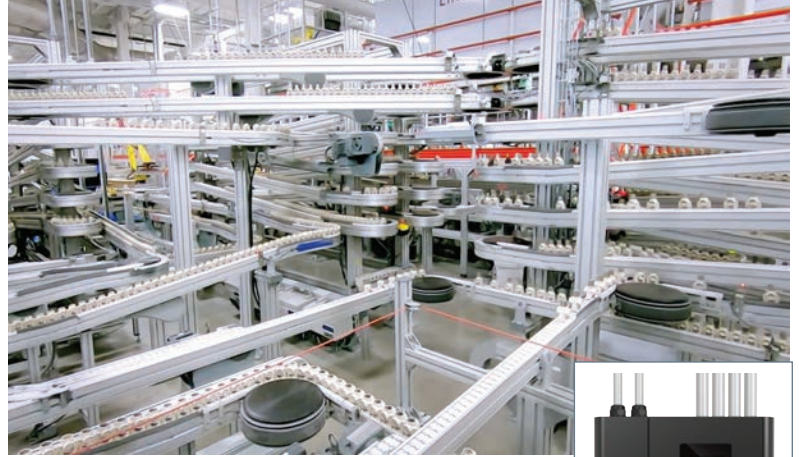
VESDA Solution – The early warning fire detection capability of VESDA will allow time for intervention to minimize or fully eliminate the need for evacuation. If a fire worsens and becomes threatening, the VESDA detection system can provide information of hazardous conditions to staff and fire fighters by pinpointing the source of the fire. VESDA has flexible design options, cost-effective installation, and programmable thresholds to ensure complete detection. With VESDA's centralized test and maintenance capability, servicing and testing can be performed at the detector unit, further reducing setup time and cost. Additionally, it provides visibility and remote access to restricted areas without having to reach or lift heavy equipment.

COMPUTER/DATA ROOMS

The Challenge – Gigafactories are high-tech manufacturing buildings, that will undoubtedly house data rooms and process control cabins – high-tech rooms that require the best, earliest, and most reliable smoke detection. Very early fire detection in a high airflow environment is a challenge and, if not protected effectively, will force ventilated smoke away from detection areas.

VESDA Solution – VESDA is specifically designed as early smoke detection in data room environments and companies across the world rely on VESDA to ensure business continuity. By carefully studying each system to strategically install detection pipes, VESDA will reliably detect diluted smoke from at the first instance of an electrical fire. The nature of the VESDA-E VEA Point Addressable ASD means that it can even offer effective detection inside data cabinets.
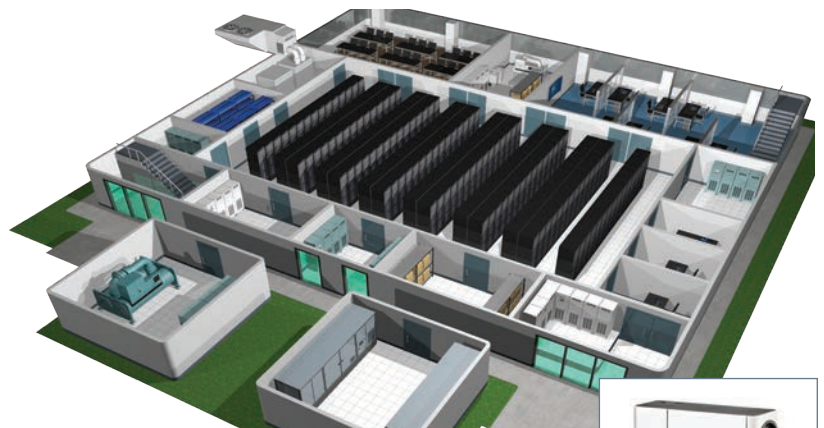
HVDC SWITCHGEAR/PROCESS CONTROL

The Challenge – Electrical substations and switch rooms are a critical component of an industrial site business continuity plan. Electrical components within substations and switch rooms are especially susceptible to fire. A fire within a building is devastating, but smoke can be just as destructive and can cause long term damage to PCB's.

Depending on the facility, these rooms can all be in one space or, more often, are distributed around the building adjacent to the process lines. This adds further complexity to the system design as cabinets needing early smoke detection are dotted across buildings.

VESDA Solution – VESDA offers considerable flexibility in design since sampling through holes in pipes means it can be engineered to suit complex design requirements. VESDA systems have a wide selection of detectors to service all kinds of applications. High sensitivity detection allows early fire intervention allowing for a timely response and controlled shutdown to minimise downtime.

For example, VESDA-E VEA offers pinpoint fire location with 40 microbore sampling tubes to provide a targeted alarm.

CELL/MODULE ASSEMBLY

The Challenge – Li-ion battery cell production consists of three main process steps: electrode manufacturing, cell assembly, and cell finishing. Electrode production and cell finishing are largely independent of the cell type, while cell assembly varies between pouch, cylindrical, and prismatic cells.

Regardless of the cell type, the smallest unit of any li-ion cell consists of two electrodes and a separator isolating opposing electrodes. Ion-conductive electrolyte fills the pores of the electrodes and the remaining space inside the cell. It is possible that at various stages of assembly electrolyte vapour could leak and cause a thermal runaway event.

Li-ion Tamer Solution – Li-ion Tamer electrolyte vapour sensors are designed to detect trace amounts of cell vapour or leakage with a binary sensor. This enables an absolute and finite detection method providing the earliest possible warning of a faulty cell with a corroded separator. Conventional gas detectors – e.g., point detectors for hydrogen (H_2), carbon monoxide (CO), and carbon dioxide (CO_2) - will only activate when smoke is ignited in the later stages of thermal runaway when a fire is well underway (see graphic in the next page).

Detection Performance: Li-ion Tamer vs Conventional Gas Detection

Setup A: Battery Rack
- Chemistry: NMC
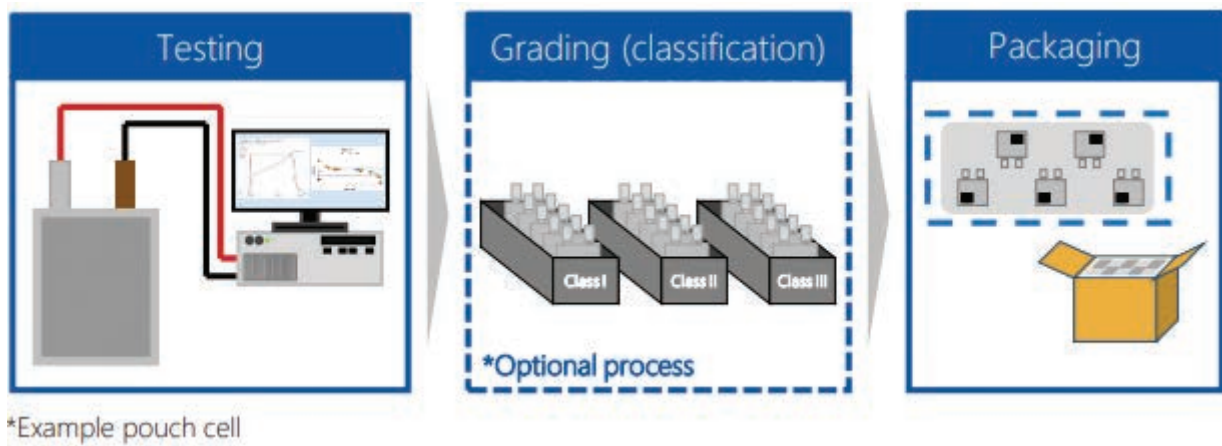- Form: Cylindrical
- Abuse: Over-Heat (UL9540A)
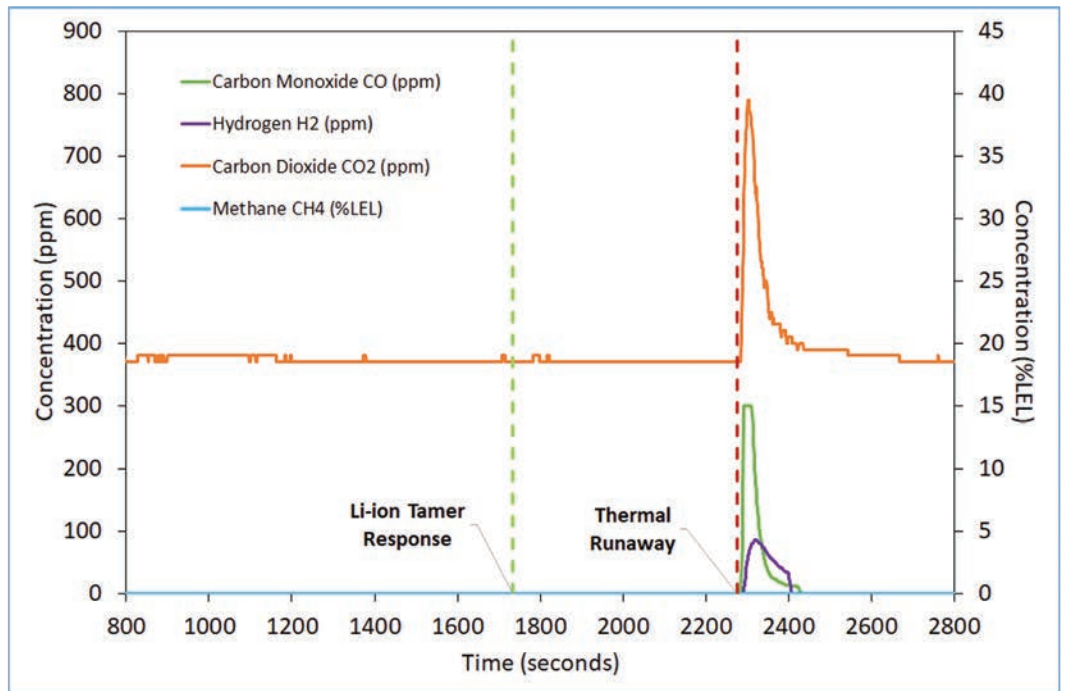
There were no responses from any of the conventional gas detectors during the electrolyte vapour event or prior to thermal runaway.

EOL PREP/QA TESTING

The Challenge – Once the manufacturing process is complete, batteries will be tested – a processes ranging from de-gassing to aging (at both high and normal temperature) before final EOL Testing. Depending on the manufacturer, EOL testing will include pulse tests, internal resistance measurements (DC), optical inspections, OCV tests, and leakage tests.

Li-ion Tamer Solution – Li-ion Tamer should be an integral part of these manufacturing and testing processes as its unique ability to detect even the minutest presence of battery electrolyte vapour provides the assurance of a healthy battery. Pin-point detection will also increase manufacturing process safety levels. Li-ion Tamer also includes several references sensors that will decrease the risk of costly "false positives" which could trigger unneeded suppression protocols.

Testing — *Example pouch cell

Grading (classification) — Class I, Class II, Class III — *Optional process

Packaging

STORING BATTERIES

The Challenge – The storage and transport of finished cells also pose fire risks. Even the smallest of overlooked defaults could cause catastrophic losses when batteries are stored together in high volumes. Thermal Runway propagation in warehouses have caused major fires and significant loses in the past year alone.

Li-ion Tamer Solution – Mitigating storage and transport risk is critical for the overall safety of gigafactories. Li-ion Tamer can provide individual battery pallet detection ensuring safety in every step of the manufacturing process all the way to storage, transport, and delivery. Li-ion Tamer is the only device capable of detection early enough to help prevent a potential catastrophic loss. Install the latest and most stringent safety measures in the industry– USE LI-ION TAMER.
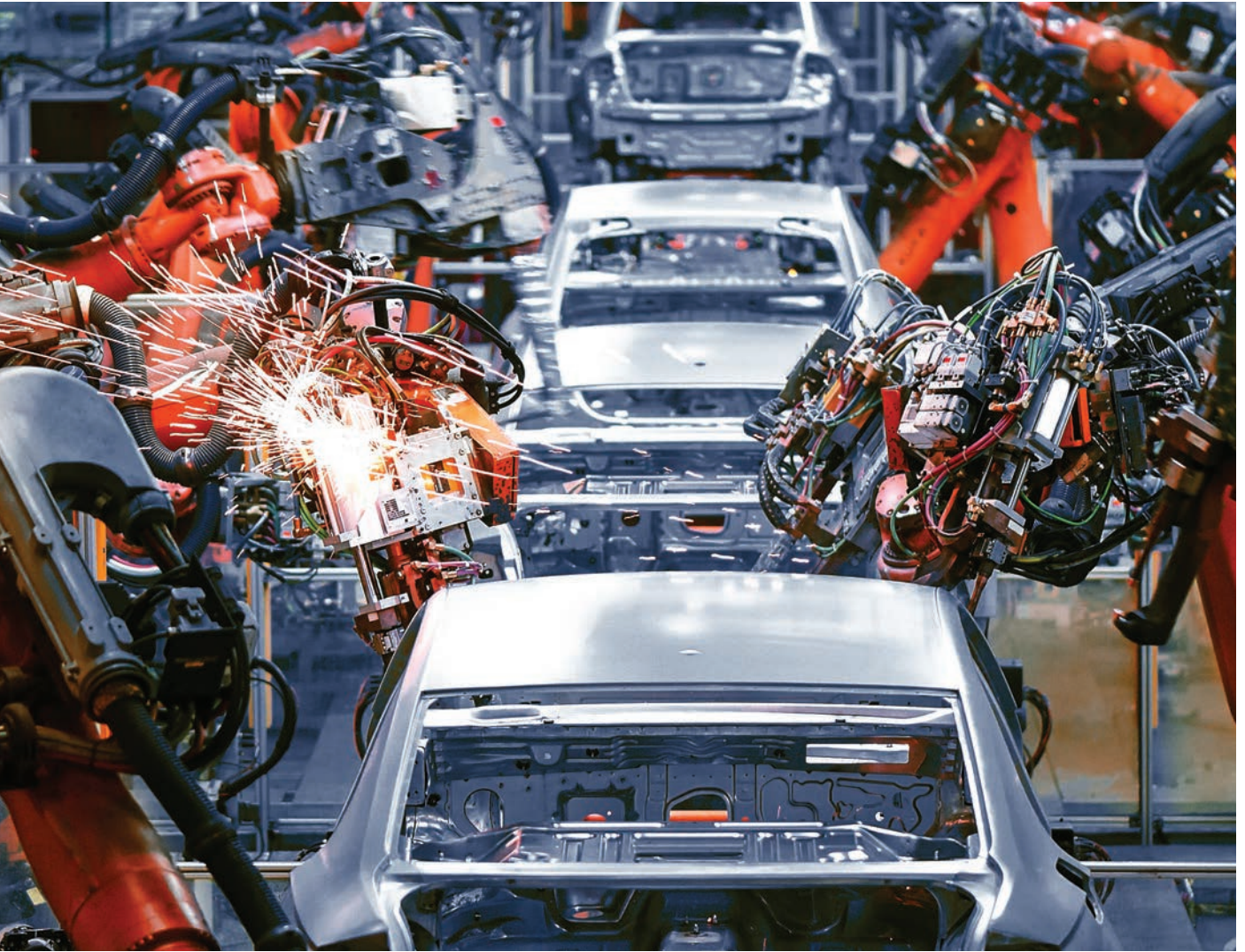
ABOUT XTRALIS

Xtralis is a leading global provider of powerful solutions for the very early and reliable detection of smoke, fire, and gas threats. Our technologies prevent disasters by giving users time to respond before life, critical infrastructure or business continuity is compromised.

We protect highly valued and irreplaceable assets and infrastructure belonging to the world's top governments and businesses.

To learn more, please visit us at www.xtralis.com.