

SINCE 1889



Yamato Scientific

Ovens for Drying Moisture in Lithium Battery Manufacturing

Contents

- Methods of Removing Moisture in the Manufacturing Process of Lithium Batteries
- Principle and Features of Vacuum Drying
- Yamato Scientific Ovens in the Lithium Battery Manufacturing Line

Moisture in Lithium Battery

Water and impurities are the biggest hazards for lithium batteries!

- When water vaporizes, it increases in volume by 1,700 times and is electrolyzed into oxygen and hydrogen.
- Under certain circumstances, such as overcharging, high ambient temperatures, continuous use, etc., the severe expansion and conduction of water causes the internal resistance of the battery to increase sharply, the temperature to rise, and the shell to expand.
- The battery consumes a lot of energy overcoming internal resistance, generates a huge amount of heat, and the temperature rise causes the separator to melt, which leads to low efficiency of the battery and even safety problems.
- Moisture and overheating can also cause the positive electrode material LiPF₆ to decompose, resulting in inefficient battery performance.

Moisture Removal during Lithium Battery Manufacturing

- Moisture needs to be removed during electrode manufacturing. Ensuring effective moisture removal and minimizing the time required for this process is important.
- The battery assembly process must be carried out in a dry environment.
- Before injecting the electrolyte into the battery, the battery must be completely dried, but without heating.

Drying Methods

Convection

Conduction

Radiation

**Gravity
Convection**

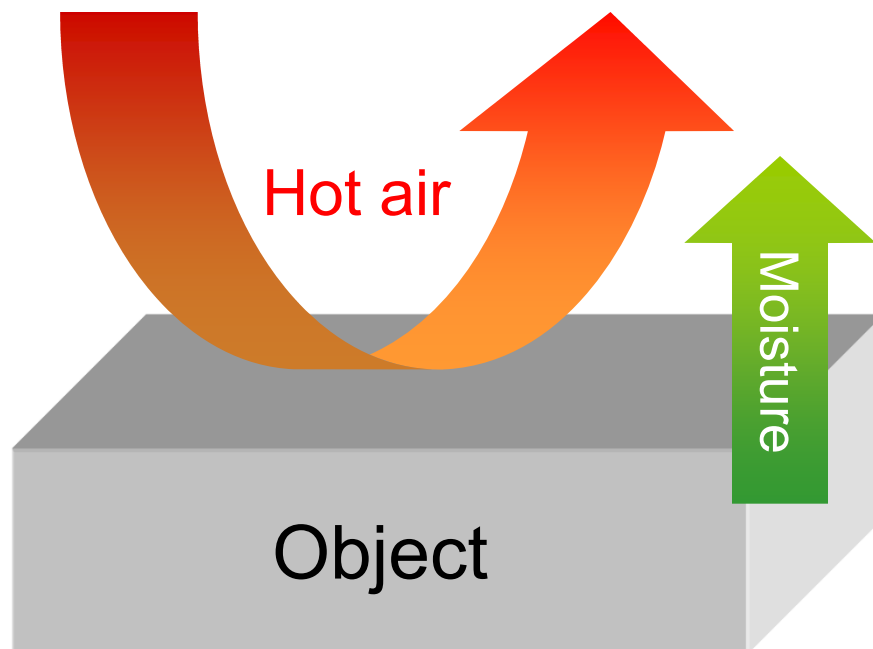
Medium
(gas or liquid)

**Mechanical
Convection**

Solid

Vacuum Drying

Drying Method: Convection

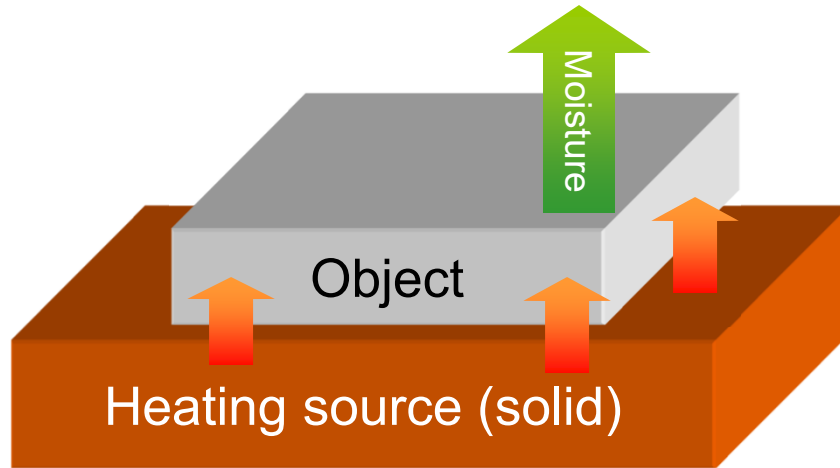


Yamato Gravity Convection Ovens

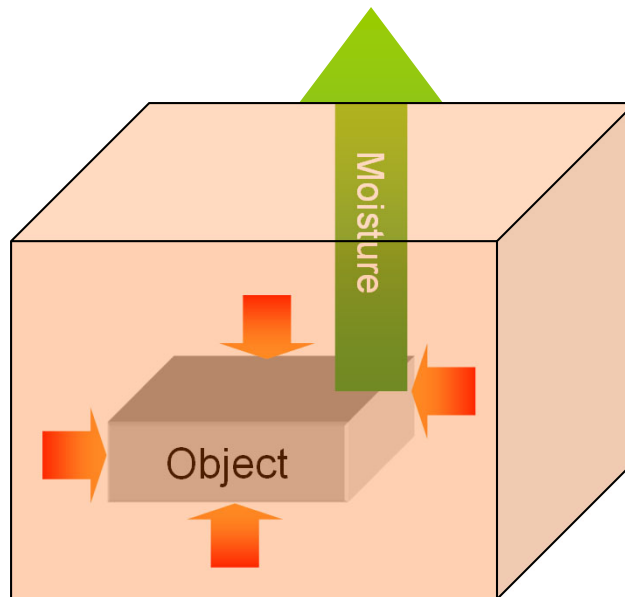


Yamato Mechanical Convection Ovens

Drying Method: Conduction

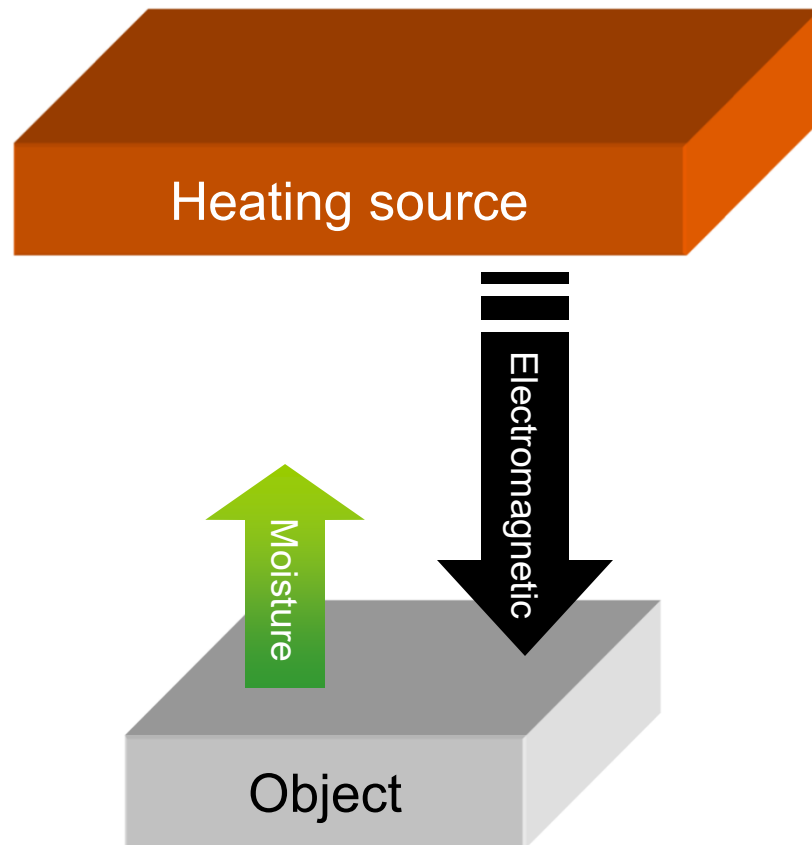


Yamato Vacuum Ovens with Shelf Heating



Yamato Ovens with Air Heating

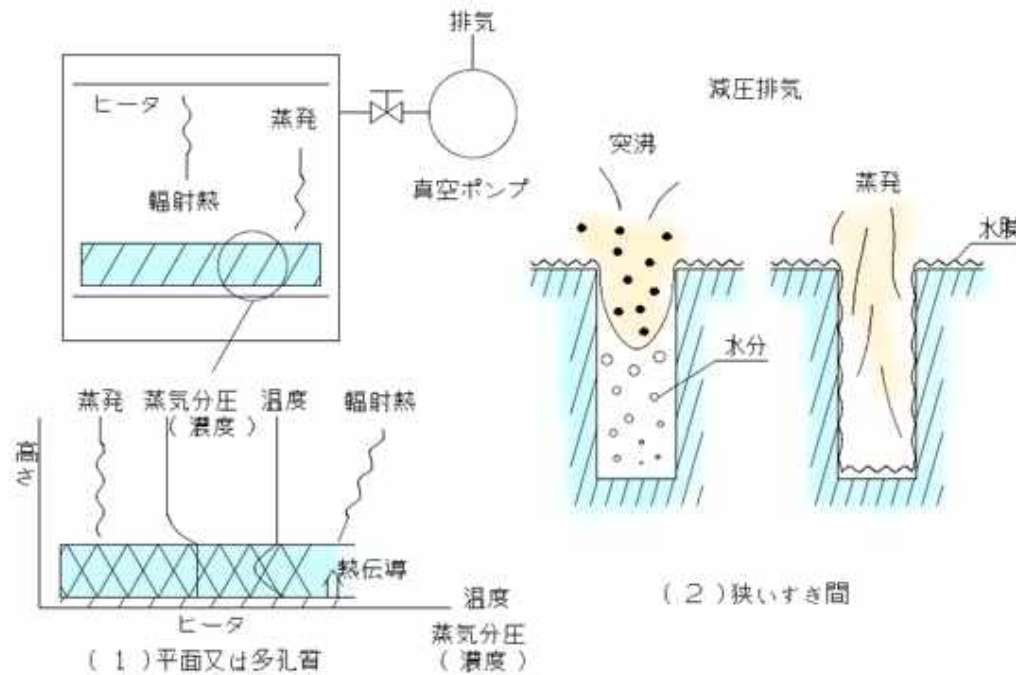
Drying Method: Radiation



Yamato Far-infrared Oven

Principle and Features of Vacuum Drying

Principle of Vacuum Drying



Yamato Vacuum Oven

Remove the moisture from the pores and micro-structures

Features of Vacuum Drying

- Moisture can be removed at low temperatures.
- Water can be removed from the microstructures (e.g., inside the electrode coil or the liquid tank before the electrolyte is injected).
- Moisture can be completely removed in a short time.
- Oxidation of the electrode material can be prevented.

※ Samples that cannot be completely dried under atmospheric pressure can be dried under vacuum conditions.

Yamato Vacuum Drying Ovens

NEW



Features:

- The overshoot during heating is minimal
- Good temperature stability at low temperature (40 °C)
- Meets the cleanliness requirements when used with a dry vacuum pump

Yamato Scientific Ovens

In the Lithium Battery Manufacturing Line

Vacuum Drying for Electrode Material, Electrode and Electrode coil



Vacuum drying oven with shelf heating



Vacuum drying oven with mechanical convection

Vacuum Drying Oven with Shelf Heating



Electrode plate drying



Electrode coil drying

Vacuum Drying Oven with Mechanical Convection



Vacuum Drying Ovens



Applications:

Drying of electrode material and electrode coil during lithium battery manufacturing.

Features:

- Two chambers (upper and lower), controlled independently
- Max. temperature: 200 °C
- Space for the vacuum pump is reserved at the bottom

Vacuum Drying Ovens



Applications:

Drying of electrode material and electrode coil during lithium battery manufacturing.

Features:

- Two chambers (upper and lower) ,controlled independently
- With shelf heating, heat rapidly
- Fan cooling + water cooling (air cooling), the cooling speed is fast
- Max. temperature: 250 °C



Vacuum Drying Ovens

Applications:

Drying of electrode material during lithium battery manufacturing.

Features:

- Two chambers (upper and lower) controlled independently
- Max. temperature: 200 °C
- Automatic control for vacuum and heating



Vacuum Drying Ovens

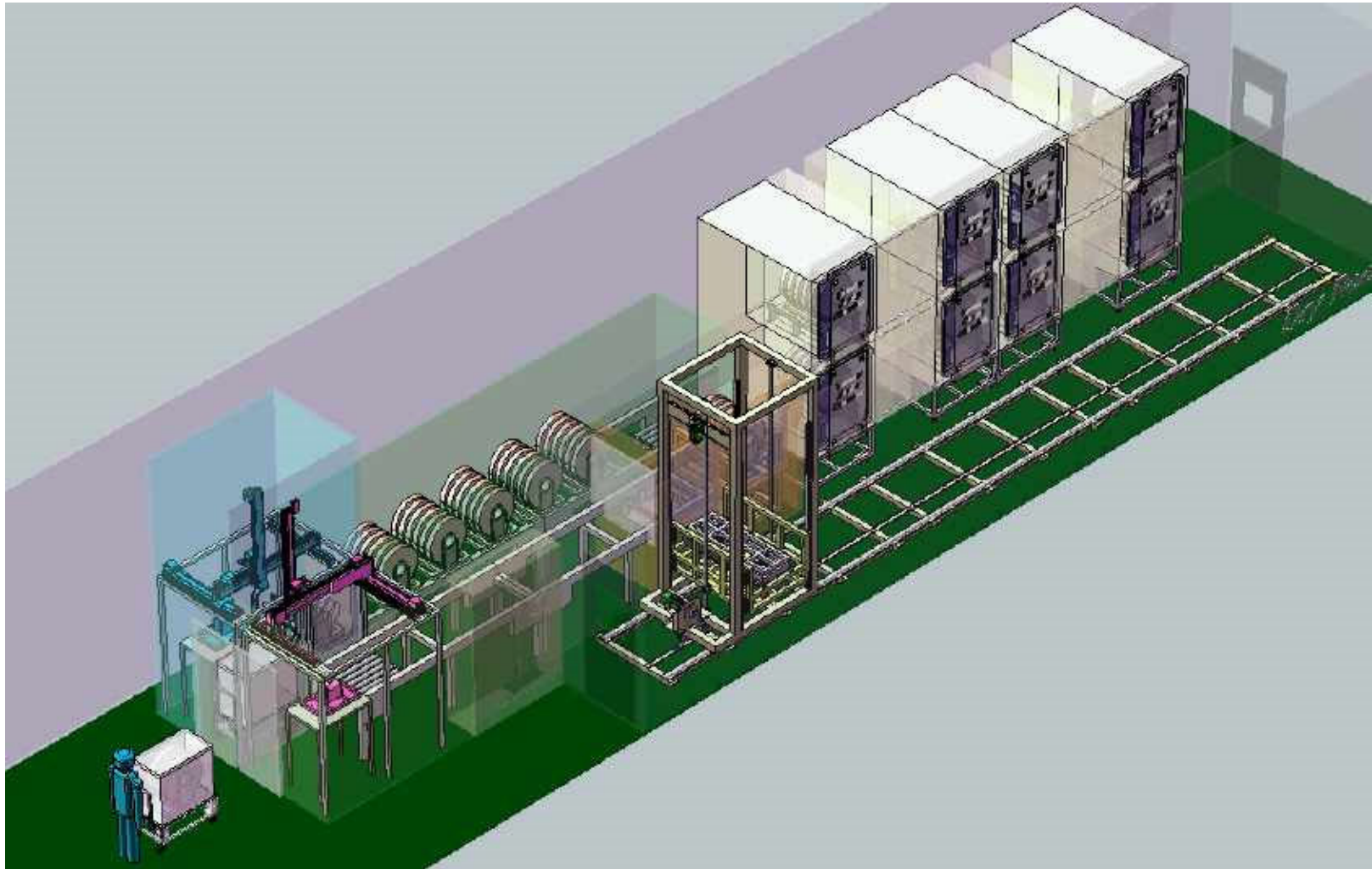
Applications:

Drying of electrode coil during lithium battery manufacturing.

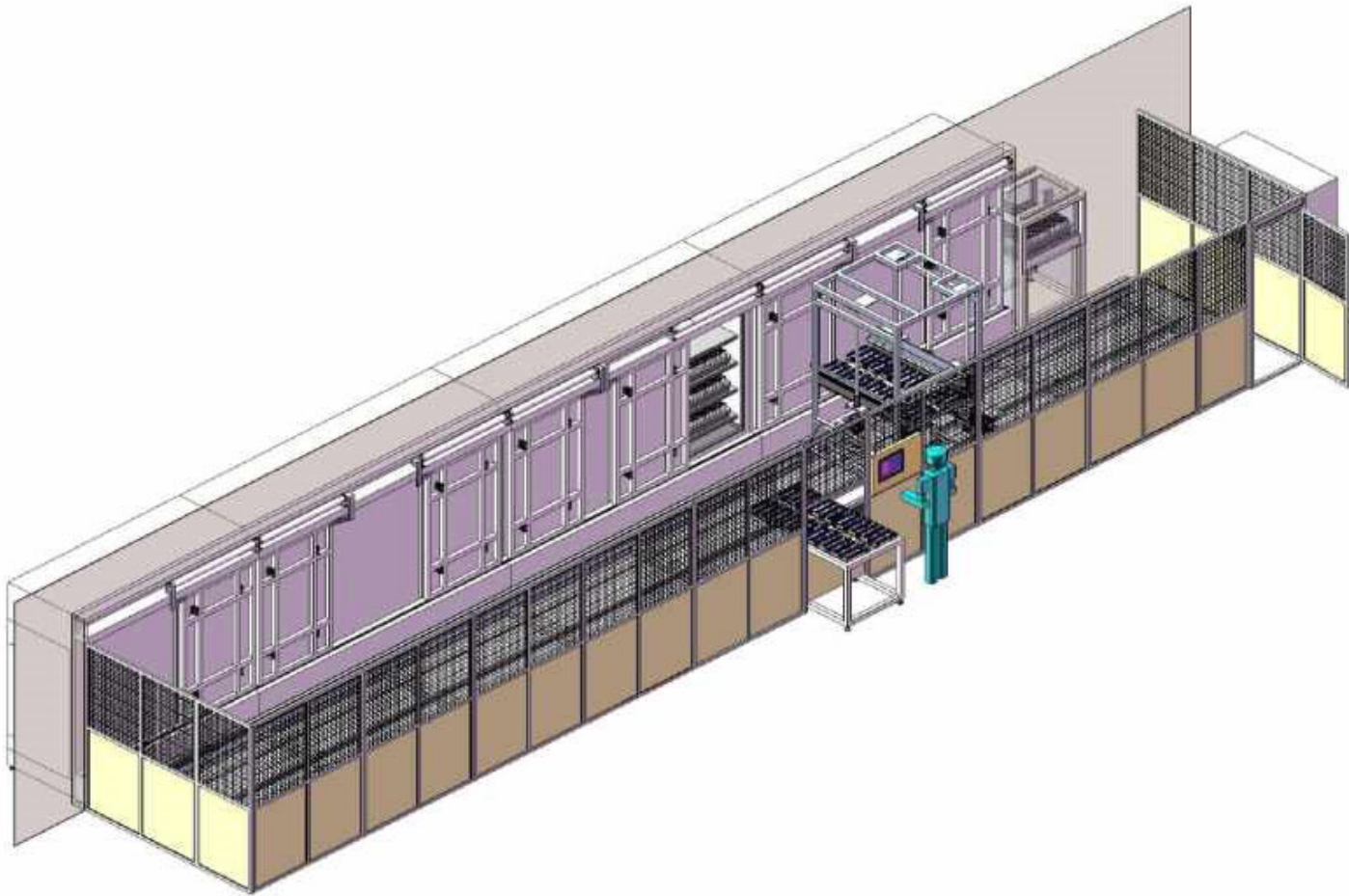
Features:

- Two chambers (upper and lower), controlled independently
- Far-infrared heating
- Mechanical convection
- Oxygen concentration monitoring in real time
- Max. temperature: 300 °C
- Water cooling

Vacuum Drying Line for Electrode coils



Battery Vacuum Drying Line Before Injection



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Thank You!