

CARBOJET™. High-speed gas injection for advanced heat treatment.



Description

CARBOJET™ is a patented technology by Linde Gas which allows for better gas convection in heat treatment furnaces without ventilators. By injecting small amounts of nitrogen at high velocities (250-300 m/s) into several parts of a roller hearth furnace, CARBOJET™ creates a movement in the furnace gas to ensure homogeneous gas and temperature distribution. CARBOJET™ can be installed in every continuous furnace for neutral annealing, carburizing and decarburizing. CARBOJET™ can also be used in pit furnaces for wire annealing with nitrogen or natural gas/nitrogen mixtures.

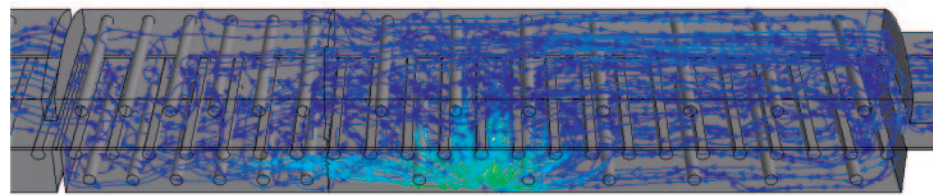
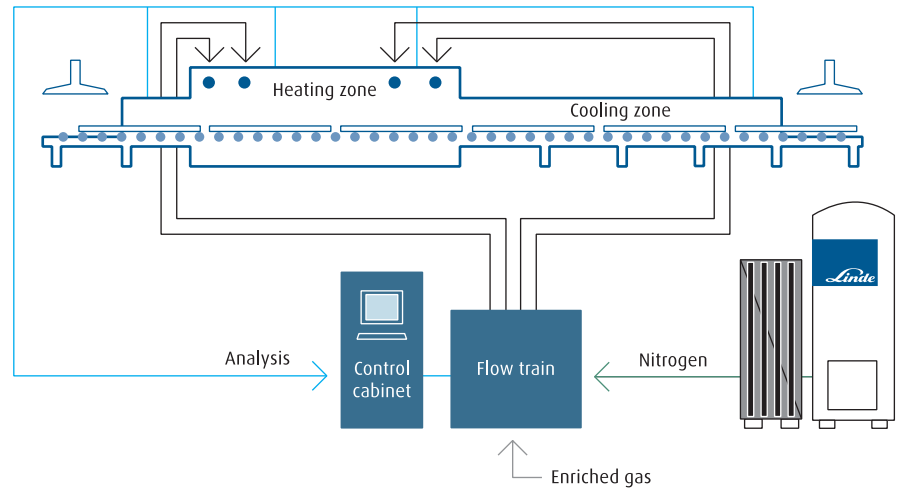
Benefits

- CARBOJET™ homogenizes product quality in tube annealing and other heat treatment furnaces using endogas, exogas or monogas.
- CARBOJET™ increases the utilization of carburizing gases and reduces the soot formation in heat treatment furnaces (such as roller hearth furnaces and walking beam furnaces). The high-speed injection of gases also optimizes the functionality of analyzing equipment due to better gas mixing.
- CARBOJET™ increases the carbon transfer on material surfaces due to forced convection of protective gases.
- CARBOJET™ allows a faster switch of atmospheres.
- CARBOJET™ allows the use of higher carbon potentials due to advanced premixing of gases.
- CARBOJET™ optimizes the heat transfer in furnaces with convective heating.

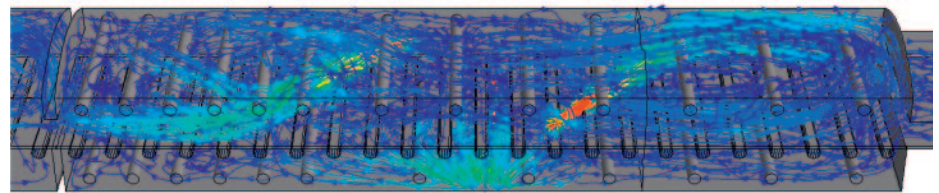
System

The system consists of one or several CARBOJET™ lances with piping and flow train. The number of lances is adapted to the furnace size and the existing gas consumption. The lances can be controlled manually or through a CARBOFLEX® control unit. The specially designed lances are made of heat resistant material to ensure a long lifetime. In order to provide tailor-made solutions, Linde Gas adapts its CARBOJET™ systems to individual customer needs.

CARBOJET™ is applicable to any continuous furnace for heat treatment. Linde Gas has extensive experience using CARBOJET™ in roller hearth furnaces and walking beam furnaces.



Gas velocities in the endogas injection area of a roller hearth furnace, calculated with the CFD program FLUENT. The overall gas velocities are relatively low. Only in the region of endogas injection a significant gas velocity is visible.



Gas velocities in the endogas injection area of a roller hearth furnace with two CARBOJET™ lances, calculated with the CFD program FLUENT. The overall gas velocities are significantly higher. Red areas represent particularly high gas velocities. The overall gas consumption of both simulations is equal.

Atmosphere supply

Nitrogen can be stored in and supplied by on-site liquid tanks, but Linde Gas also offers competitive CRYOSS® on-site gas production units. In order to allow for higher carbon potentials, acetylene, propane or natural gas can be added through CARBOJET™ lances. Propane is supplied in tanks or cylinders, acetylene is supplied in cylinders or bundles.

References

Linde Gas has installed several CARBOJET™ lances in several European tube annealing companies.

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