

CARBOJET®. High-speed Gas Injection for Advanced Heat Treatment.

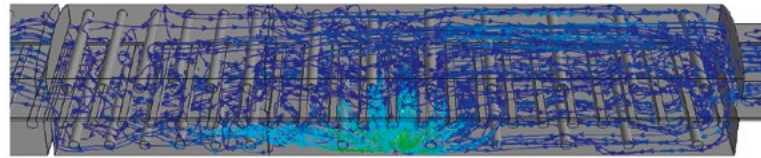
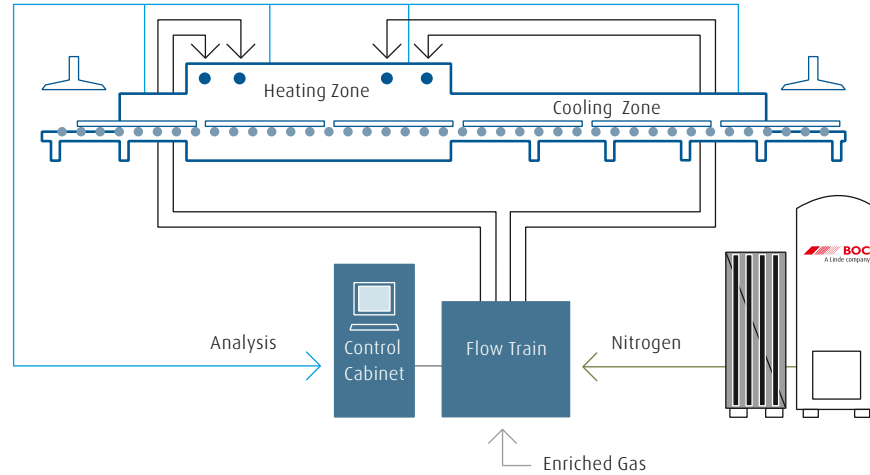


Description CARBOJET is a patented technology by Linde Gas (BOC is part of the Linde group) which allows for better gas convection in heat treatment furnaces without ventilators. By injecting small amounts of nitrogen at high velocities (250–300 m/s) into several parts of a roller hearth furnace, CARBOJET 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, carburising and decarburising. CARBOJET can also be used in pit furnaces for wire annealing with nitrogen or natural gas/nitrogen mixtures.

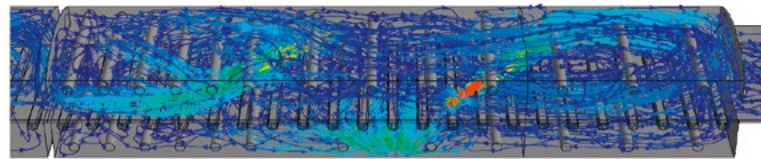
- Benefits**
- CARBOJET homogenises product quality in tube annealing and other heat treatment furnaces using endogas, exogas or monogas
 - CARBOJET increases the utilisation of carburising gases and reduces the soot formation in heat treatment furnaces (such as roller hearth furnaces and walking beam furnaces). The high-speed injection of gases also optimises the functionality of analysing 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 optimises 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. 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 and BOC have installed several CARBOJET lances in several European tube annealing companies.

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