

CARBOLITE
IGERO 30-3000°C

part of **VERDER**
scientific



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Fig. 1: Top Hat Furnace
HB 18/80

Modern Solutions for Safe Debinding of Ceramic Parts

Technical ceramics are manufactured in powder-based production processes. The ceramic powder component is formed via various manufacturing steps and is finally sintered.

Organic binders are applied to ensure cohesion of the powders during and after shaping. They are used, for example, for the injection molding process, isostatic presses, hot presses, slip casting, tape casting, extrusion and numerous additive manufacturing processes. The binder needs to be removed before sintering, a step which is commonly referred to as debinding.

When debinding oxide ceramics like alumina or zirconia, the binder can be thermally combusted in the presence of air. For non-oxide ceramics, a constant flow of inert gases is required for debinding.

During thermal debinding or pyrolysis, gaseous hydrocarbons are released. These form an explosive mixture when concentrated in the furnace chamber which **has led CARBOLITE GERO to develop sophisticated safety concepts for safe debinding.**

Safe debinding in air

For the production of some ceramic or oxide ceramic components, this solution represents a safe method of debinding in air. The **furnace types HTF and HB** are equipped with a fresh air fan and a fresh air heater. The fan ensures the air supply required for the debinding process. The resulting exhaust gases are fed into the afterburner for safe combustion.

Benefits:

- Monitored supply of preheated fresh air
- Symmetrically arranged gas inlet valves with flow meter (rotameter) for fresh air
- Afterburner (compressed air and propane gas) for combustion of exhaust gases
- Hot air gas blower with controller and exhaust flaps
- Automatically activated safety state in the event of a breakdown

Safe debinding under protective gas atmosphere or for pyrolysis processes

If non-combustible protective gases are used for debinding or pyrolysis processes, the furnace is purged with protective gas. The resulting exhaust gases are burnt directly in an afterburner. CARBOLITE GERO offers a range of suitable furnaces like the **Annealing Furnace GLO**.

Benefits:

- Afterburner (compressed air and propane gas) for combustion of exhaust gases
- Heated gas outlet
- Controlled gas flow with slight overpressure
- Fully automatic Siemens control system
- Nitrogen-filled flooding tank
- Inert status creation in the pre-program

Safe debinding under combustible gases

With the use of combustible gases such as hydrogen, automated safety systems are required to ensure secure operation and compliance with existing regulations.

Benefits:

- Pre-program with evacuation step, leakage test and overpressure test
- Safety-related PLC control with touch panel for automatic operation
- Nitrogen-filled flooding tank for purging the furnace in the event of a failure
- Bypass for safe flushing of the furnace with nitrogen/argon in the event of a failure
- Afterburner (compressed air and propane gas) for combustion of process gas
- Heated gas outlet
- Fully automatic flow control for all process gases
- Hydrogen sensor for operation under hydrogen
- Controlled gas flow for combustible gases with slight overpressure
- Control of gas inlet pressure and gas flow for all process gases

Safe catalytic debinding with Nitric Acid

The debinding of Catamold® feedstock is performed catalytically with nitric acid. This process demands precise control of both the temperature profile and gas pressures. The **Debinding Furnace EBO** is used for this application.

Benefits:

- The safety management system eliminates the chance of explosive mixtures in the furnace
- Before debinding, the retort is flushed with nitrogen in a controlled manner to displace the atmospheric oxygen. Debinding is carried out with a controlled excess of nitrogen to prevent an explosive atmosphere
- Safety door interlock
- Afterburner (compressed air and propane gas) for combustion of process gas
- Fully automatic Siemens control system
- Dosing of the delivery rate of the acid pump
- Controlled nitrogen volume flow
- Certified safety management



Figure 2: Annealing Furnace GLO 40/11



Figure 3: Debinding Furnace EBO