NITREX

CARBURIZING & CARBONITRIDING

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A TRADITIONAL SURFACE HARDENING TREATMENT WITH MODERN PROCESS CONTROLS

WHAT IS IT?

Carburizing is a process of controlled diffusion of carbon into the surface of a component, followed by quenching and tempering, with the objective of increasing the component's surface hardness.

The process is generally applicable to low carbon and low alloy steels. There are two carburizing process types available commercially – vacuum carburizing and conventional carburizing. The former is described in a separate brochure, and conventional carburizing is discussed here.

In this thermal process ferrous alloys are heated to above their transformation temperature and exposed to carbon rich atmosphere. Processing temperatures in conventional carburizing typically are in the 1450°F - 1900°F (790°C - 1040°C) range. The diffusion of carbon into the part and the subsequent quench leads to a part with a hard, wear resistant surface and a tough, shock resistant core.

Carbonitriding is a process similar to carburizing except that ammonia is added to the carburizing atmosphere, which produces an effect of supplementary nitrogen diffusion into the component and results in a higher surface hardness.

HOW IS IT DONE?

Gaseous carburizing is the most popular form and is typically performed in integral oil quench furnaces or pit furnaces, using carbon atmosphere control equipment (such as supplied by NITREX throughout the world) to maintain the proper carbon atmosphere as required by the case structure and the recipe. For deep case applications, higher temperature vacuum carburizing, also offered by NITREX, may be a more economical process.

Loading a Carburizing Furnace

Carbonitrided Thrust Washers, 1004 Steel

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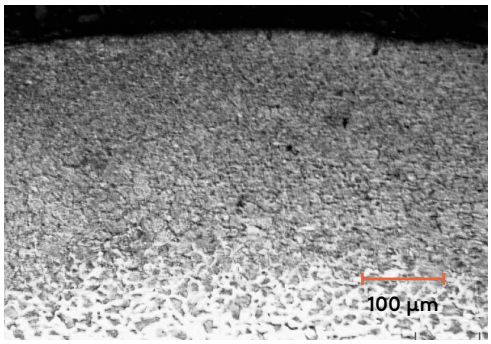
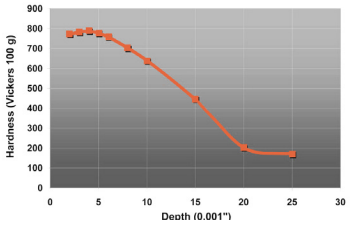
METHODS TO CONTROL THE GAS CARBURIZING PROCESS:

- Oxygen probes (as designed and offered by NITREX) are integral to process control, and for adding enriching carbon gas to an endothermic atmosphere, via gas flow metering
- NITREX carbon profile simulation software allows better control
- NITREX temperature and furnace controls further assure precision processing
- The quench design and quench media (i.e. oil) determines the core properties.
- Tempering determines final core and final surface properties



Microstructure of Carbonitrided Thrust Washers



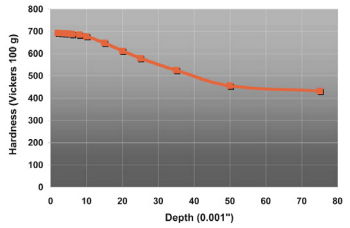
Hardness Profile of Carbonitrided Thrust Washers

WHAT CAN BE TREATED?

The process is common with carbon steels and low alloyed steels and some select higher alloyed steels.

Typical applications include:

- Gears
- Bearings
- Ball screws
- Sleeves
- Races
- Rollers
- Bushings
- Pinions
- Shafts,
- Pins
- Ball joints



Hardness Profile of Carburized Rail Car Coupling

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WHY CARBURIZING OR CARBONITRIDING?

The reasons to use this process in preference of any other heat treating method are as follows:

- High surface hardness with a tough, durable core
- Case depths up to 0.250" are achievable
- Ability to use inexpensive steels and still produce components with hard surface properties
- Generally used for parts subjected to cyclical loading
- Cost effective for parts where some distortion is acceptable
- Carbonitriding is recommended for applications where a deep case is not as critical as a very hard surface. It is more common with low alloy carbon steels and is also typically a shorter cycle.

ALTERNATIVES

Designers will normally consider one of the following options:

- Vacuum Carburizing (LPC), with either high pressure gas quench for less distortion or oil quench.
- Gas Nitriding, for very hard outer case with tribological benefits, used largely with alloyed and pre-hardened steels.
- Selective surface hardening, using masking methods, to allow for selective areas of lower hardness for welding, threads, etc.

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