Innovative solutions for large machine parts

Efficient, environmentally friendly, productive: surface treatment with BALITHERM IONIT

Open a new world of possibilities with BALITHERM IONIT
Contact us today!

You can find a full listing of our locations at: www.oerlikon.com/balzers
The surface hardening solution for machine parts

Nitriding is a classical and powerful surface hardening method where nitrogen diffuses into the surface to form a several hundred micrometer thick diffusion zone and a wear resistant compound layer.

At Oerlikon Balzers, we have the largest plasma nitriding equipment worldwide, enabling the treatment of large machine parts such as wind turbine ring gears, marine gears or large propellers.

Your benefits of the BALITHERM IONIT nitriding process

- A controlled process that allows the precise nitriding depth according to the customers’ requirements and the individual adjustment to specific applications.
- Precise temperature control also at low treatment temperatures (standard 480 °C) for excellent surface structure and dimension control of large parts.
- No remachining required.
- Largest plasma nitriding equipment worldwide, enabling the treatment of huge machine parts: up to 40 tonnes and to a diameter of 3 metres by a length of 10 metres (d3 x 10 m).
- Environmentally friendly process as no poisonous gases or chemicals are used.

Where can our surface treatment solutions support you?

Nitriding depth and hardness depend on steel composition, nitriding temperature and treatment time: Oerlikon Balzers runs standard recipes for customers, or applies individual customer-tailored processes.

<table>
<thead>
<tr>
<th>Material group</th>
<th>Materials number</th>
<th>ASTM / SAE / AISI</th>
<th>Hardness [HV 0.1]</th>
<th>Hardness [HRC]</th>
<th>max. NHD [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey cast iron</td>
<td>EN-JIS 2070</td>
<td>0.7070</td>
<td>100-70-03</td>
<td>&gt; 800</td>
<td>&gt; 64</td>
</tr>
<tr>
<td>Tempered steel, alloyed</td>
<td>42NiCrMo6</td>
<td>1.6565</td>
<td>4340</td>
<td>800-900</td>
<td>64-67</td>
</tr>
<tr>
<td></td>
<td>34CrNiMo6</td>
<td>1.6582</td>
<td>4337</td>
<td>800-900</td>
<td>64-67</td>
</tr>
<tr>
<td></td>
<td>42Mo4</td>
<td>1.7225</td>
<td>4140</td>
<td>800-900</td>
<td>64-67</td>
</tr>
<tr>
<td></td>
<td>32CrMoV9</td>
<td>1.7707</td>
<td>4340</td>
<td>800-950</td>
<td>64-68</td>
</tr>
<tr>
<td>Nitriding steel</td>
<td>31CrMoV9</td>
<td>1.8519</td>
<td>–</td>
<td>800-950</td>
<td>64-68</td>
</tr>
</tbody>
</table>

Sometimes even small dimensional growth is not acceptable: BALITHERM® IONIT, a plasma nitriding process, offers a very precise process control and significantly less growth and distortion compared to gas nitriding processes, even for large parts. This precision is especially important for wind turbine gears.

Example: wind turbine ring gear
Diameter 2 m, 1.8 t

BALITHERM® IONIT shows significantly less distortion compared to gas nitriding. The plasma surrounds the gear geometry very homogeneously.

Roundness: 20 µm (5 times better than GNC*)
Parallelism: 15 µm (8 times better than GNC*)
Flatness: 15 µm (7 times better than GNC*)

*gas nitrocarburising
The special BALITHERM® IONIT ST (Stainless Steel) process increases the cavitation resistance of propellers made of stainless steel (e.g., 17-4 PH, 10-20 µm diffusion depth, 900 HV hardness).

Nitriding processes generally have small dimensional changes and distortion, as the typical nitriding temperature of 480 °C is below tempering temperature (typically > 600 °C) and most of the nitrogen diffuses into the material. Wind turbine ring gears are exposed to high loads, the surface performance is limited by the surface fatigue (pitting) resistance. The pitting resistance depends on the surface hardness profile.

The FZG institute of Cogwheel & Gear Construction of the Technical University of Munich (TU Munich) has analysed the pitting resistance of BALITHERM® IONIT treated gears:

Pitting damage of gear flanks

Steel: 42CrMo4
Module: 5 mm
NHD: 0.45 mm
Compound layer thickness: 14 µm

The FZG institute of the TU Munich concluded that the allowable stress number of BALITHERM® IONIT treated 42CrMo4 steel lies significantly above gas nitriding and achieves a higher quality than 31CrMoV9 steel.

The BALITHERM® IONIT treatment of steel 42CrMo4 achieves a nominal contact stress of 1285 N/mm² in the FZG pitting test.

Marine gears for ship engines demand high resistance against wear, friction and bearing pressures. Surface fatigue with pitting appears and reduces the lifetime of untreated gears. BALITHERM® IONIT treatments enhance the surface resistance against pitting and increase significantly the lifetime of marine gears.

The BALITHERM® IONIT for large wind turbines

The BALITHERM IONIT for large wind turbines

Applications of BALITHERM IONIT: treatment of large ring gears

Gear flank cross section

Marine gear

Size: Ø 3000 mm, Weight: around 5 t

All given data are approximate values, they depend on application, environment and test conditions.
Our service process: the decisive advantage for more efficiency

Cleaning BALITHERM® IONIT

Quality control

Component delivery

Incoming inspection

Component shipping and subsequent application

Our INAURA systems are developed for the treatment of huge components. They provide a loading capacity of Ø3 x 10 metres and 40 tonnes. The fully automated process ensures a stable and controlled wear-protection treatment procedure. The combination of hydrogen, nitrogen and electricity means that BALITHERM® IONIT operates entirely without the use of poisonous gases and chemicals.

BALITHERM IONIT – with respect for the environment

BALITHERM® IONIT is an environmentally friendly treatment.

Compared to gas nitriding:

- 10-20 times less consumption of treatment gas.
- Ammonia is replaced by ordinary nitrogen, therefore no post-combustion is needed and no CO₂ and NOₓ will be emitted.