

# What is the best nitriding method?

## SUMMARY,

### Nitriding is:

## DEFINITION

A surface hardening process that is applied to parts made of steel, cast iron, titanium and nickel alloys.

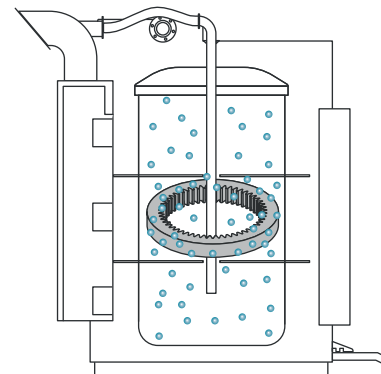
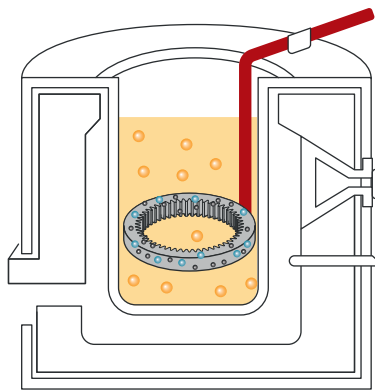
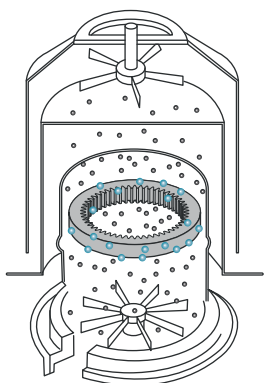
## OBJECTIVE

Nitriding improves hardness and resistance to wear, fatigue and corrosion, without altering the part's core properties.

## PROCESS

Introduction of nitrogen into the surface of the parts to form nitride compounds with the material's own alloying elements.

However, what are the methods to running nitriding?



### Gas

### Salt bath

### Plasma

### Description of the process

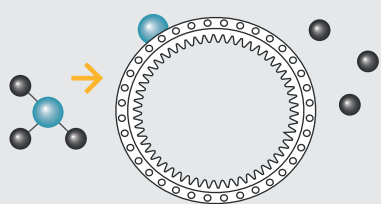
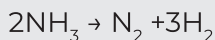
It consists of exposing steel parts to an atmosphere rich in ammonia gas at elevated temperatures. The gas dissociates, releasing nitrogen atoms that diffuse on the surface of the material.

Immersing the metal parts in a cyanide containing salt bath. At high temperature, salts dissociate into cyanide and sodium ions. Cyanide ions are the source of nitrogen and carbon that diffuse on the surface.

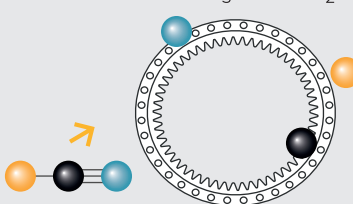
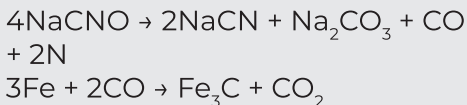
It consists of subjecting the parts to a bombardment of nitrogen ions, which are absorbed by the surface and form nitride compounds with the alloying elements of the material.

### Principle

#### NH<sub>3</sub> | Ammonia diffusion

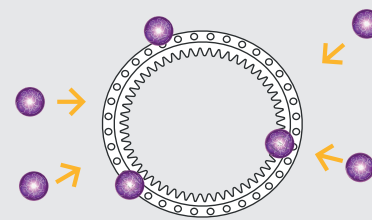


#### NaCN | Cyanide salts diffusion



#### N<sup>+</sup> | Nitrogen ion bombardment

Gas with electric charge



### Temperature

520-600°C / 968-112°F

570-620°C / 1058-1148°F

350-800°C / 662-1472 °F

### Process time

10-120 hours

2-4 hours

Up to 120 hours

### Nitrided layer

0.05 - 0.7 mm  
(50 - 700 micrometers)

0.05 - 0.15 mm  
(50 - 150 micrometers)

0.05 - 0.7 mm  
(50 - 700 micrometers)

### Advantages

Deep nitrided layers.  
Flexibility in part size and easy furnace loading.  
Possibility of doing nitriding and FNC. (Ferritic Nitrocarburizing)

Short treatment times.  
Thick Compound zone (White Layer).  
Cheap solution.

Deep nitrided layers.  
Sputtering (pre-cleaning).  
Repeatable metallurgical results.  
Environmentally friendly gasses.  
Low Decarb / gas consumption.  
Masking of selected surfaces.  
Potential for nitriding and FNC.

### Disadvantages

Use of corrosive gasses.  
No cleaning effect.  
Hard to nitride stainless steels.  
Not easy control of thermodynamic reactions.  
High gas consumption.

Unsealed or complex parts can trap the salt solution even after vigorous rinsing.  
Corrosion/pitting if immersed for a long time.  
Shallow case.  
Prohibited in some locations due to environmental pollution.  
Poisonous.

Deep holes and cuts.  
Hollow cathode + Edge effects.  
Costly initial investment.

