



S³P

Specialty Stainless Steel Processes

Martina Wagner

Agenda



- Why Stainless Steel
- S³P Value Propositions
- S³P Technology
- What makes S³P a Unique Process
- S³P Growth Rate
- Outlook for S³P

S³P

Specialty Stainless Steel Processes

Corrosion

A problem as old as mankind



Stainless Steel

- Well established since 1912
- High corrosion resistant
- Protective passive layer
- Self healing
- Some are non-magnetic
- Good properties but not for all applications



Typically used in...

- Medical industry
- Food and beverages processing
- Pumps and valves
- Fastening solutions
- Automotive industry
- Consumer products
- Chemical Industry
- Oil & gas Industry

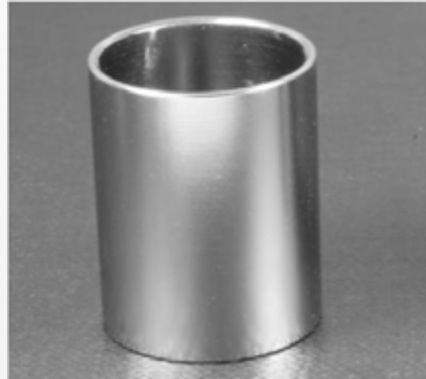


Stainless Steel

is very good for corrosion resistance

But untreated Stainless Steel has many problems...

S³P value propositions



Untreated

✓

✗

✗

✗

✗

Resistance to...

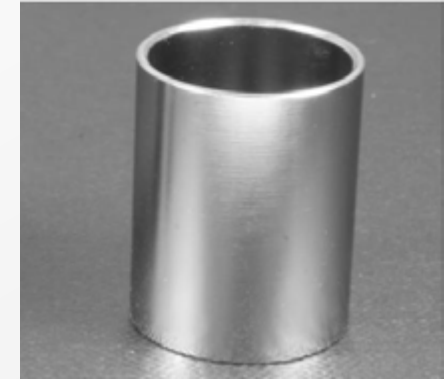
Corrosion

Wear

Galling

Fatigue

Cavitation



S³P treated

✓

✓

✓

✓

✓

S³P technology

S³P is **low temperature diffusion** of Carbon into the surface of the parts

No components are added to the material that are not already present

The process exhibits very high **uniformity & reproducibility**

Why are these important?

No distortion after the S³P process

Parts **retains fatigue strength** after cold deforming

Parts can be **welded after treatment**, which reduces manufacturing costs

Ductile products - not brittle

Very high uniformity and reproducibility

Why is this important?

- Uniform Quality of products
- Ability to produce consistent results
- S³P process better than 6-Sigma*
- Bodycote controls all the steps from furnace design through to processing parts

Six Sigma (6σ). A six sigma process is one in which 99.99966% of all opportunities to produce some feature of a part are statistically expected to be free of defect



Ductility*

Highly ductile parts can bend without cracks

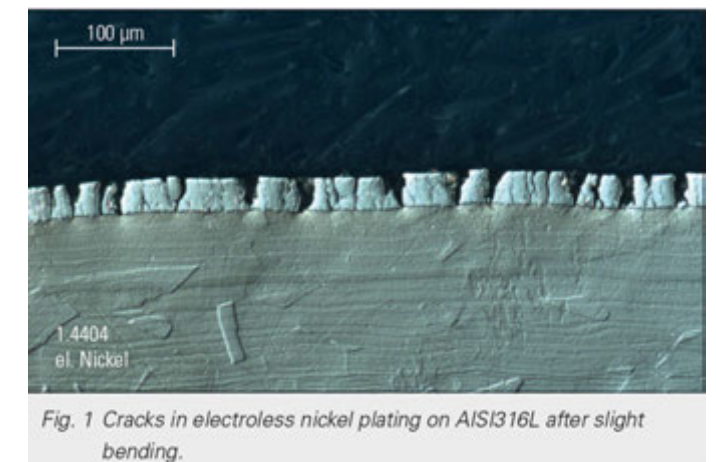
Why is it important?

- If a part or a machine fails
- If parts are subjected to unintended high loads (parts may bend)

Very important for:

- Medical
- Food and Beverage
- Automotive
- **Actually most market sectors**

* Ductility is a measure of a material's ability to undergo significant plastic deformation before rupture



Anti galling* effect

What is galling?

Why is this important?

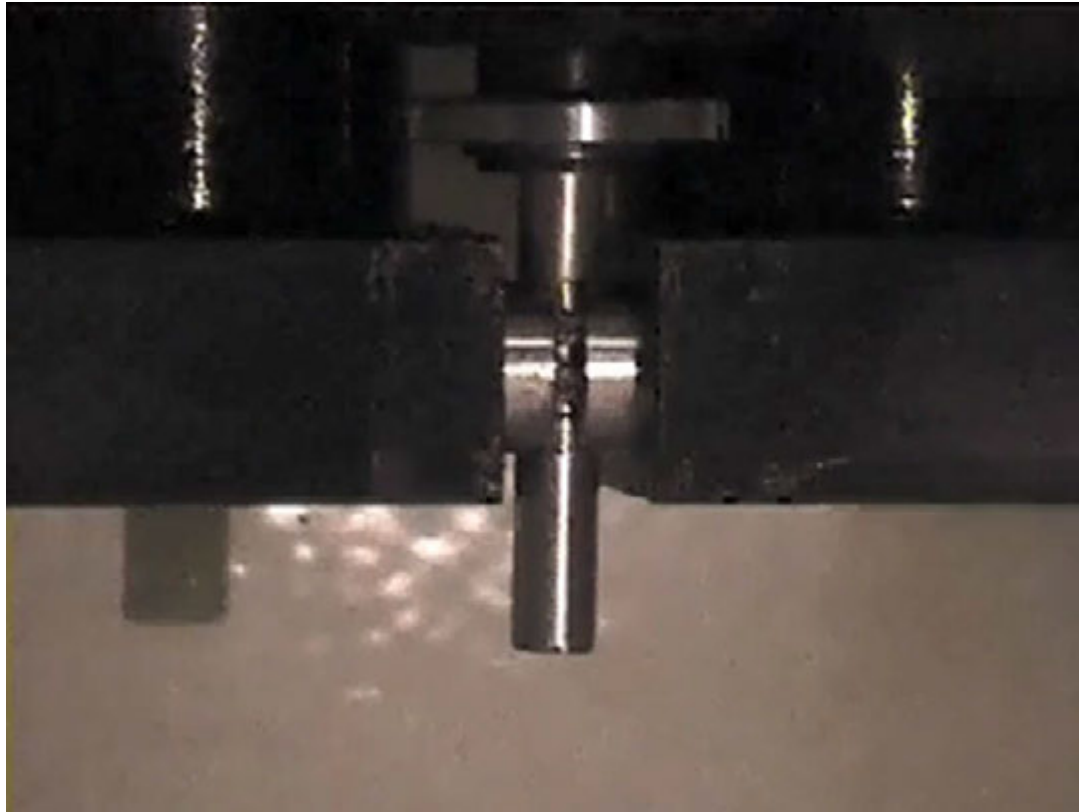
- Metal-on-Metal sliding possible - no O-rings needed
- Parts can be re-assembled many times
- When galling happens – parts are destroyed

Applies to all market sectors

*Galling is a type of mechanical wear caused by a combination of friction and adhesion between sliding surfaces. Further mechanical forces cause the material to become stuck or welded to the mating surface.

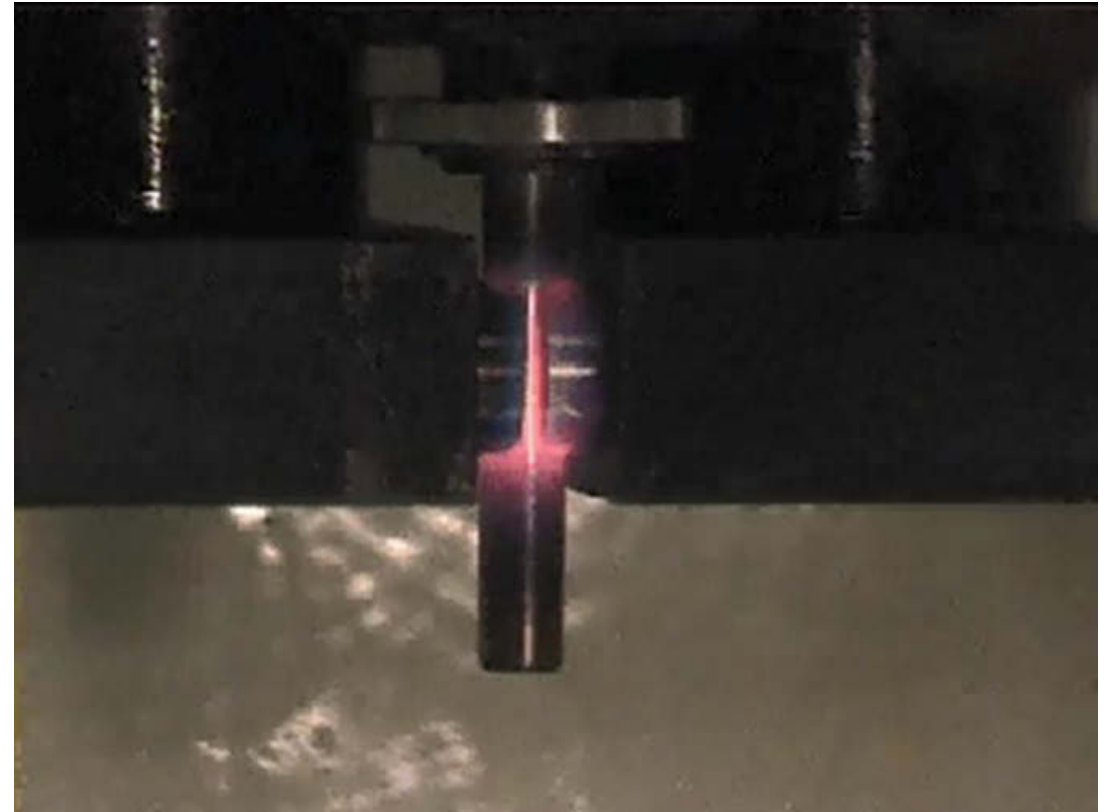


Galling eliminated with S³P



Time to failure: AISI 316L - untreated

~ 1.5 s



Time to failure: AISI 316L – S³P K33

~ 60 s



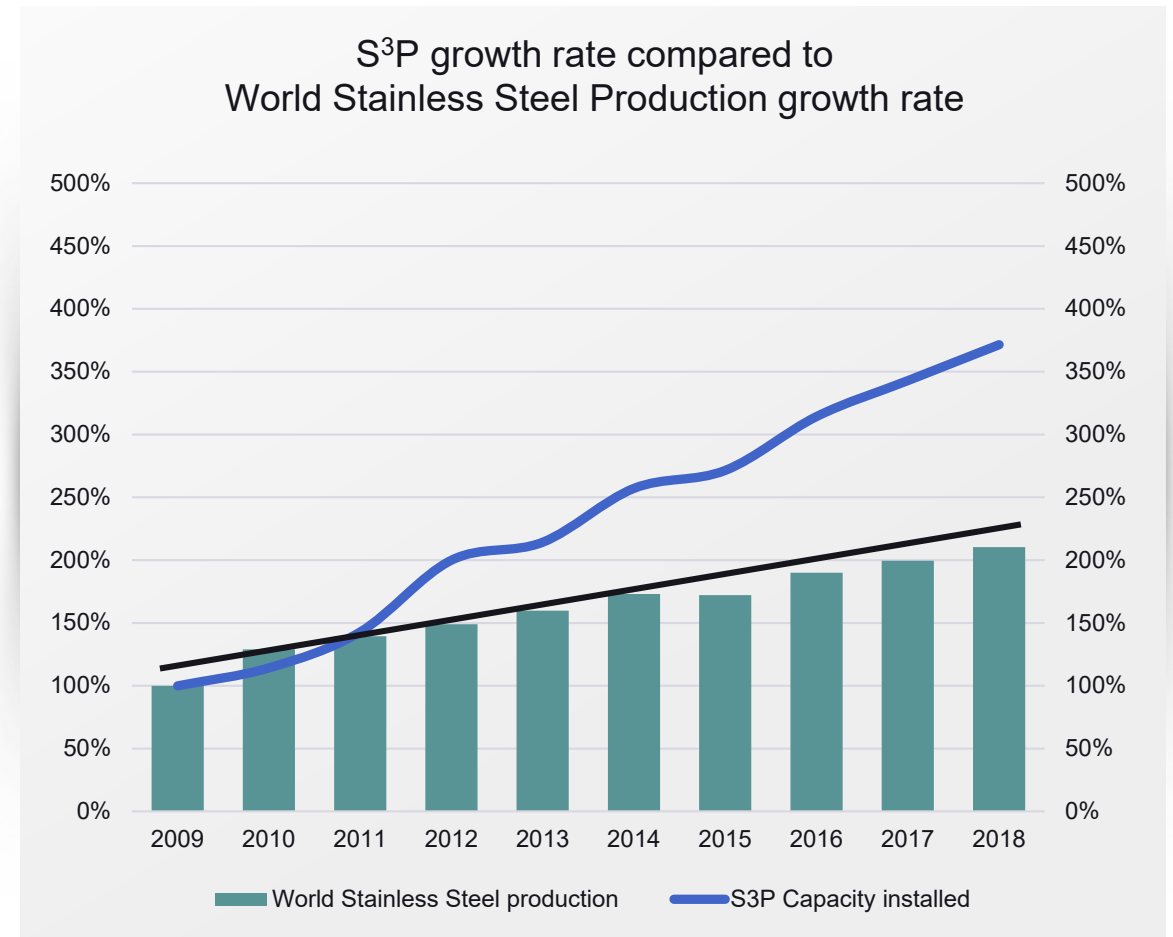
What makes S³P a Unique Process



- Surface hardening of Stainless Steel / Ni-base / Co-base
- S³P process is a Bodycote Proprietary Process
- Bodycote owns the process IP
- Bodycote owns and operates the process lines in dedicated facilities - worldwide
- Bodycote designs, builds and commissions the process lines

S³P growth rate

- The annual growth of the global stainless steel market is circa 6%
- Approximately 48 millions tonnes of stainless steel are produced every year, with a much higher pace of growth than the overall market for metals
- Exact market size difficult to judge but the market is huge
- S³P sales are currently only serving considerably less than 1% of the total addressable market
- At the moment competition is not an issue



Stainless steel production

Production of Stainless Steel increases every year – driven by demand for better products

Market adoption

The main constraint on S³P growth rate is the pace of market adoption

S³P awareness

We regularly face customers who don't know what our process can do

- Provides new opportunities for the unique S³P process
- Bodycote missionary selling efforts are yielding an increasing rate of adoption of S³P every year

We expect to continue to see strong growth in S3P for the foreseeable future

CAPITAL MARKETS DAY

2019

