



316A - an alternative to 316L for fuel cell and electrolyzer applications

04 Dec 2025 – Ashwin Nambi – R&D Engineer

About Aperam

APERAM IS ACTIVE IN STAINLESS, ELECTRICAL & SPECIALTY STEEL
#2 IN EUROPE AND THE ONLY PRODUCER IN S.AMERICA



Stainless Steel

- > Ferritic stainless steels
- > Duplex
- > Austenitic stainless steels
- > Austenitic stainless steels containing manganese
- > Austenitic stainless steels containing molybdenum
- > Heat resistant stainless steels
- > Martensitic stainless steels

Alloys & Specialties

- > Nickel: Corrosion resistant alloys
- > Nickel Alloy: High temperature alloys & corrosion resistant alloys
- > Nickel Chromium
- > Nickel Alloy Steel
- > Cobalt Alloy Steel
- > Miscellaneous alloys
- > Iron Chromium Aluminum
- > Bimetals
- > Cobalt Alloys
- > Copper Alloys
- > Special Stainless Steels

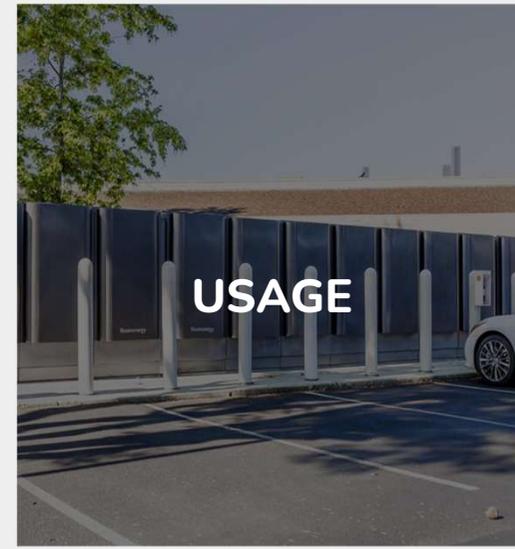
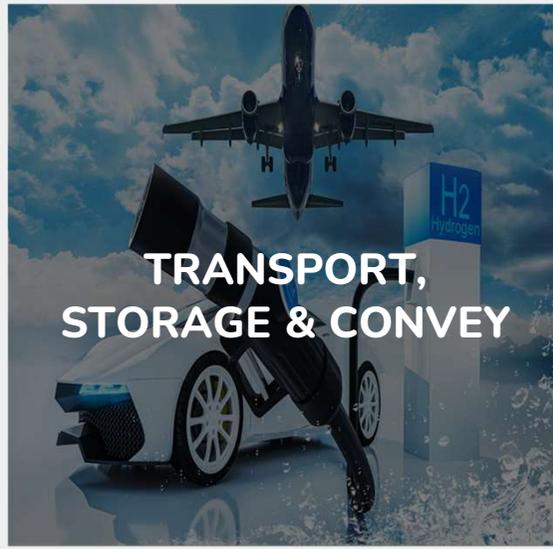
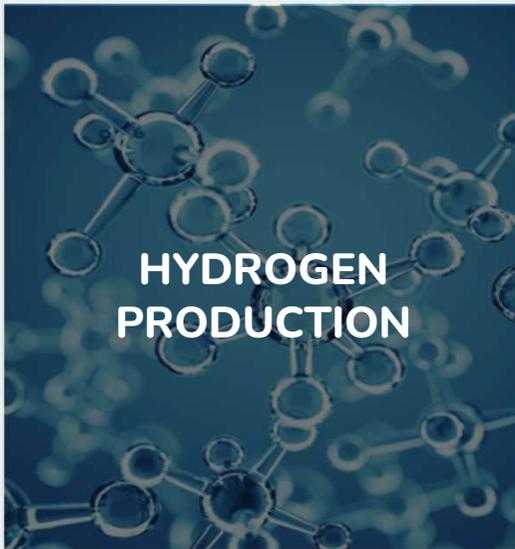
Electrical Steels @SA

- > Non oriented electrical steels (NOES) and high permeability
- > Grain oriented electrical steels (GOES)

Hydrogen Segment

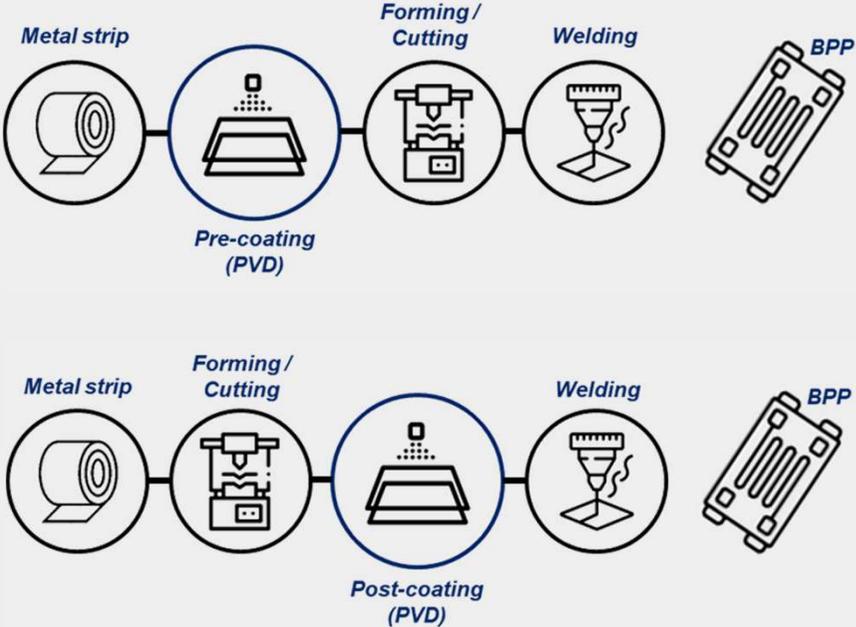
Hydrogen is a key actor in the energy transition.

At Aperam, we recognize the **key role** we can play in shaping a sustainable hydrogen ecosystem. With our expertise in stainless steel production, we bring **innovation, reliability**, and a profound **commitment** to a greener tomorrow.



Let's navigate the complexities of the hydrogen market and shape a sustainable future that benefits us all.

Metallic Bipolar plates (BPP)



Requirements

- 
 high electrical conductivity
- 
 good corrosion resistance
- 
 high gas impermeability
- 
 good mechanical performance

Account for **~20-40%** of fuel cell and electrolyzer cost. (current Metallic BPPs)

Grade Offer for Electrolysers & Fuel Cells

Electrolysis Techn.	Actual solution	Aperam Portfolio
Alkaline (AEL)	Nickel 201 & Nickel plated carbon steel	Ni201 Austenitics
Proton exchange membrane (PEM)	Ti + coating	304M - 316L - 316 B - 904L - Duplex
Solid oxide (SO)	FSS (IMPHY® 23 SO) + coating	IMPHY® 23SO Ferritics (K41- K46)
Anion exchange membrane (AEM)	316B Nickel plated carbon steel	304M - 316L - 316 B - 904L - Duplex

Fuel cell Tech.	Actual solution	Aperam Portfolio
Proton exchange membrane (PEM)	316L + coating	316L Alternative: ?

A Smarter, More Sustainable Alloy 🌱

316A
Stainless
Steel



FCI BPP
316L



What is 316A ?

An austenitic stainless steel grade engineered specifically to bridge the gap between cost and performance.

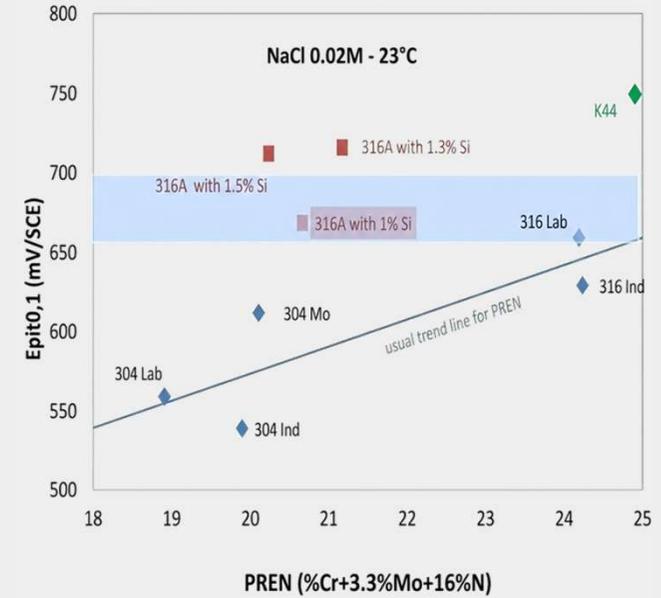
The Innovation

316A utilizes a precise Silicon-Molybdenum balance for passivity.

Structure: Fully austenitic (non-magnetic)

Status: Commercially available & proven

Grades AISI (EN 10088-2)		C	Si	Cr	Mo	Ni	N	
304L	(1.4307)	Min	-	-	17.5	-	8	-
		Max	0.03	0.8(1)	19.5	-	10.5	0.1
316L	(1.4404)	Min	-	-	16.5	2	10	-
		Max	0.03	0.8(1)	18.5	2.5	13	0.1
316A	(1.4682)	Min	-	0.8	17.5	0.4	9	-
		Max	0.03	2	19.5	0.8	11	0.1



The breakthrough : Unlocking Si/Mo Synergy

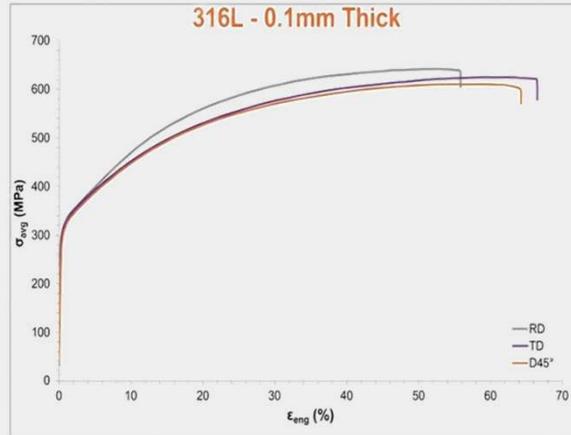
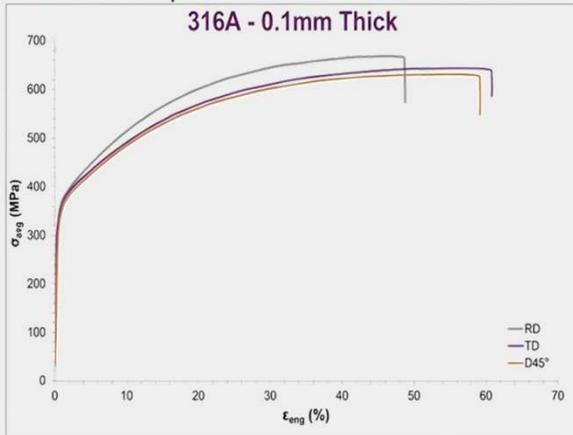
➔ increasing the corrosion resistance of the grade

⇒ 316A is over the PREN trend line

316A : a perfectly balanced chemistry, guaranteeing a fully austenitic high-performance steel

Mechanical properties: 316A vs 316L

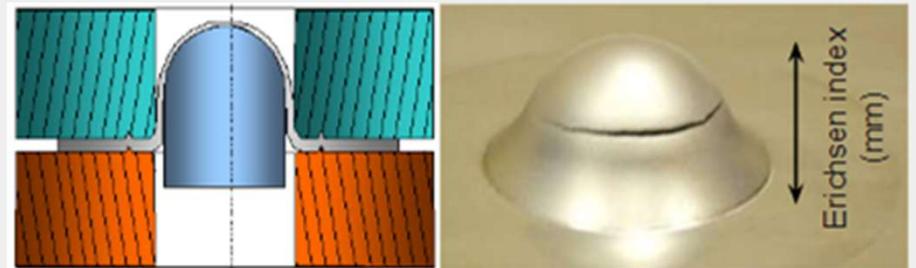
Results comparison: 316A versus 316L



Performed:

Tensile test according to ISO 6892-1 std.

Erichsen test according to ISO 20482 std.



Grades AISI (EN 10088-2)	Direction	YS (MPa)	UTS (MPa)	Ag (%)	A (%)	n	r
316A 0.1 mm	TD	325	643	54.7	60.3	0.42	0.84
	RD	330	667	46.4	50.1	0.41	0.88
	D45	316	633	52.5	57.9	0.41	0.99
316L 0.1 mm	TD	297	621	60.7	66.0	0.46	0.89
	RD	295	639	50.9	55.4	0.44	0.82
	D45	291	609	58.8	65.8	0.44	1.09

Grades AISI (EN 10088-2)	Erichsen Index
316A 0.1 mm	9.7 mm
316L 0.1 mm	9.5 mm

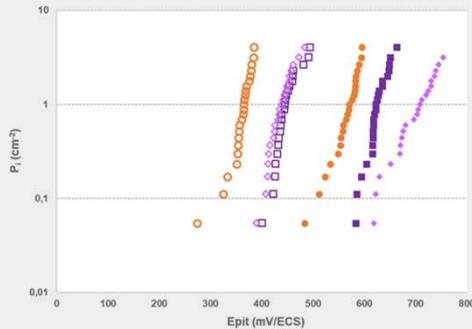
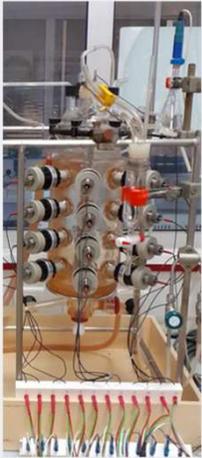
316A meets the performance threshold needed for the majority of applications. (in various thickness)

Corrosion studies - relevant

Pitting corrosion resistance

Multipitting test:

- ⇒ 24 samples/grade
- ⇒ 0.02M / 0.5M NaCl
- ⇒ 23°C and 50°C



Intergranular corrosion resistance



Performed according to ISO 3651-2 std.
Immersion in 16% sulfuric acid / copper sulfate
24h in the boiling solution



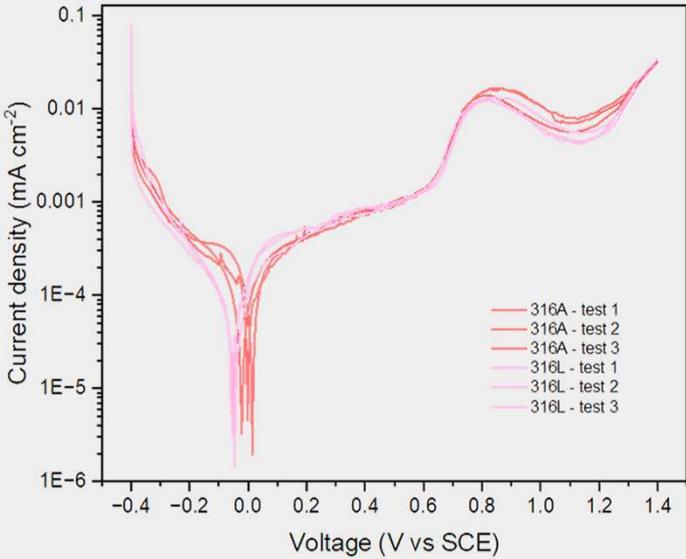
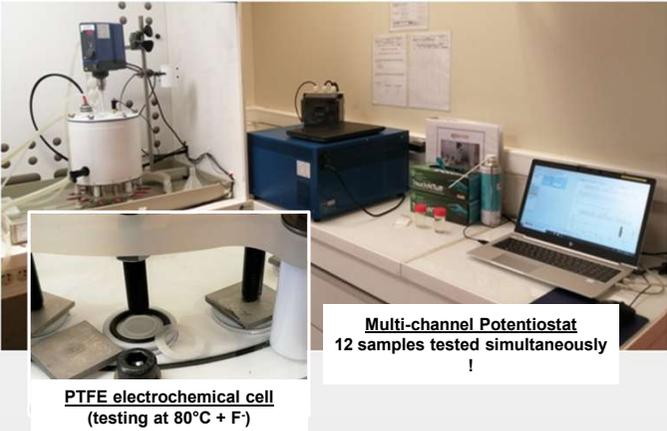
No crack detected after immersion in the boiling solution

316A successfully passed the both test and present similar behaviour to 316L.

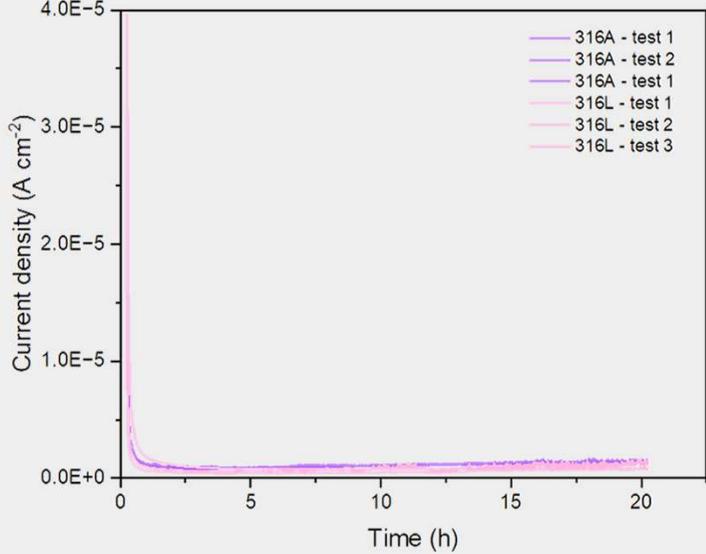
Electrochemical properties: 316A vs 316L for fuel cell conditions

Corrosion Testing:

According to modified DOE conditions - 100µm 316A vs 316L Bare samples



Potentiodynamic testing: Anodic conditions (pH=3, 80°C, 5 ppm F⁻)



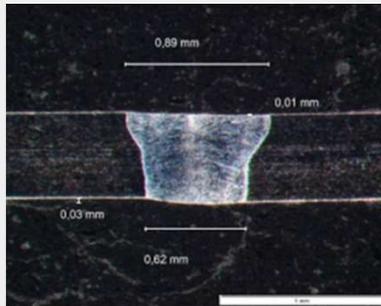
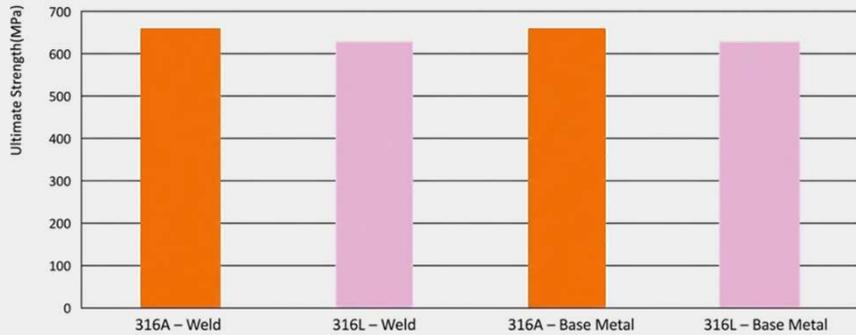
Potentiostatic testing: Cathodic conditions (pH=3, 80°C, 5 ppm F⁻, ≥0.6V)

316A and 316L exhibit similar performance under both anodic and cathodic conditions.

*Validation efforts have also been extended to include the 75µm thickness material.

Welding properties

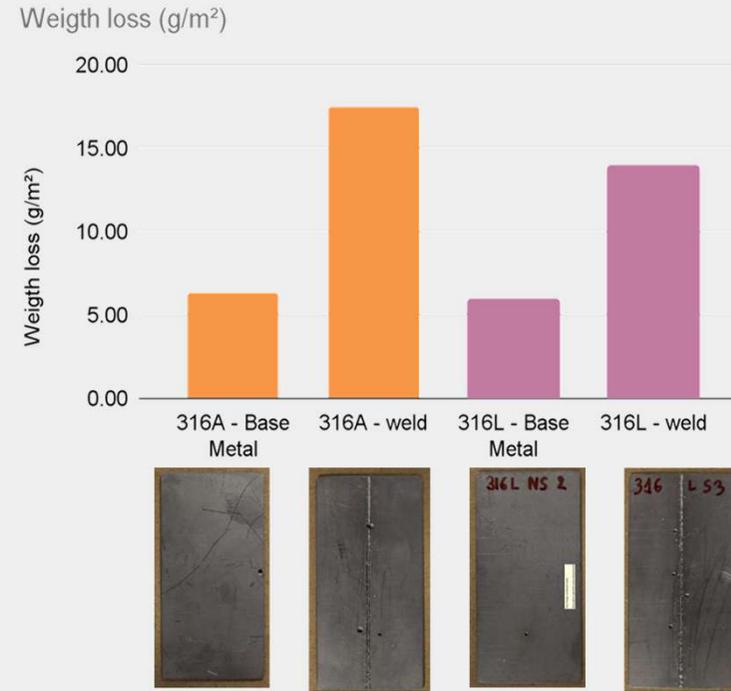
Transversal tensile test for 0.5 mm thickness



Laser Power (W)	700
Welding speed (m/min)	3

Corrosion Testing:

ASTM G48A Standard (Adjusted for 300-Series Austenitics)



Tested Conditions:

- Identical laser welding parameters used.
- No pickling performed.
- Immersion in 3% FeCl₃ solution at 20°C for 24 hours.

Base Metal (316A): Minimal pitting, primarily observed at the edges.
Welds: Pitting predominantly occurred in the Heat-Affected Zone or on spatters.

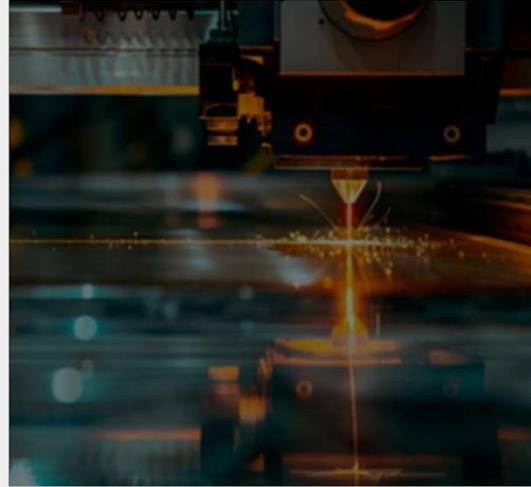
316A behaves exactly as a high-quality austenitic steel

Plug-and-Play Integration



No Tooling Changes

Because 316A maintains similar formability and elongation to 316L, existing stamping dies and hydroforming tools can be used without modification.*



Weldability

Excellent laser weldability without changing the parameters*. The low carbon content prevents sensitization.



Coating Compatibility

Currently undergoing...

Conclusion



A smarter chemistry :

An innovative austenitic grade designed around a powerful Mo-Si synergy.



Validated Benchmark Performance :

Consistently delivers

- Corrosion resistance equivalent to 316L (Pitting resistance, Uniform corrosion*, Intergranular Corrosion test (Strauss test), modified ASTM G48A)
- Mechanical properties
- Electrochemical properties - fuel cell
- Deep-drawing ability*
- Welding
- Seamless "Plug-and-Play" Integration

The Reliable, Sustainable Choice

316A offers a resource and cost-efficient composition, enhancing sustainability and manufacturability without sacrificing quality.



316A is not just an alternative; it is the material for a competitive and sustainable hydrogen future.

"Aperam is continuing extensive work and validation on this innovative grade. We are ready to partner with you to integrate 316A today and drive the hydrogen economy forward. Thank you."

