wieland

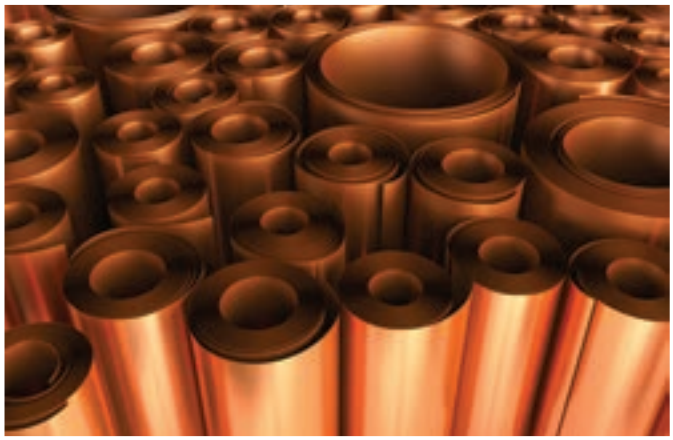
Thin Strip Products Empowering Success

200 YEARS wieland
1820–2020

Wieland Group

We have 90 locations in 32 countries.
We are a global partner with regional roots.

Custom Reroller of light gauge stainless strip and ultra-thin copper alloy foil (10-140µm)



Products

— Thin gauge stainless steel & nickel alloys
— Thin gauge copper and copper alloys
— CopperBond treated foil

Stainless Steel Alloys							
Current Alloys	Thicknesses		Width	Specs	Cores	Quantities	Surface
	Tempered	Annealed					
Austenitic Ferritic Precipitation Hardening	0.0254mm to 0.508mm	0.0762mm to 0.508mm	12.7mm to 940mm[1]	AMS ASTM EN	12" 16" 20"	1150 kgs MoQ[2]	2B, Mist, Matte, Roll brush[3] Tension leveling available

Copper Alloys										
Current Alloys	Tempers		Thicknesses		Width		Specs	Cores	Quantities	Surface
	Foil	Strip	Foil	Strip	Foil	Strip				
Copper High performance Alloys[4]	Annealed (Grade 7) or As Rolled (Grade 5)	Tempered (½ Hard ¾ Hard Full Hard)	0.010mm to 0.1mm	0.11mm to 0.508mm	12.7mm to 647mm	12.7mm to 939.8mm	IPC 4562a 4 oz < (0.142mm) – Covers Mechanical Properties	76.2mm or 152.4mm Fiber or Phenolic on AR & Steel on Annealed temper	MoQ from 250 kgs to 2000 kgs[2]	Bare, anti-tarnish, Copperbond

[1]Mill edge
[2]Grade pending
[3]Custom options available
[4]See following page for partial selection

We Find Answers to the Challenges of Tomorrow

Engineered Copper Foils Empowering the Future of 5G

The evolution of 5G will bring many advantages to our world of communication including greater speed for volumes of data, lower latency for increased velocity, and the ability for multi connectivity between devices from sensors to smart devices. A critical component to this evolution are engineered Rolled Copper foils. Rolled Copper foils' inherent properties increase the performance for 5G high frequency designs through customized microstructure, surface finishes, and strength. These characteristics of Rolled Copper foils outperform the alternative to support megatrends such as miniaturization, electrification and connectivity.

Copper Foil Attributes

- Surface roughness of rolled foils can be up to 30% smoother in terms of Ra which reduces insertion loss
- Tensile strength properties of rolled alloy foil can exceed 700 MPa increasing fatigue life and supporting denser circuit boards
- Relative rigidity allows for an increase in transmission lines and reduces yield loss caused from creases
- Skew elimination possible using rolled foil panel versus ED foil on a woven glass panels
- Reduced loss tangent with high flex rolled foil over glass epoxy
- Miniaturization of compartments benefit from rolled flex foil in Antennas, Feedlines and Beamformers
- Ability to control grain structure and orientation with rolled foil improves fatigue performance and reduces signal loss

Prototypical Copper Alloys & Nominal properties						
Alloy	Elements	Tensile Strength (ksi)	Tensile Strength (Mpa)	Electrical Conductivity (IACS)	Softens at 200°C?[1]	Softens at 300°C? [1]
K11	99.95% Cu	50	344	100	Yes	Yes
K32	99.9% Cu	40-60	275-414	100	Yes	Yes
K82	99.9% Cu 0.1% Zr	50-80	344-551	85	No	No
K65	97.4% Cu 2.4% Fe 0.12% Zn 0.03% P	60-95	414-655	60	No	No
K55	96.2% Cu 3% Ni 0.65% Si 0.15% Mg	90-110	620-758	40	No	No
Typical ED Copper Foil (for comparison)		45	310	95	No	Yes

Surface Treatments			
Treatment	Description	Composition	Feature Height
None	As-degreased surface	–	–
Anti-tarnish only	Tarnish film	Zn-Cr	–
Standard Pink	Electroplated Cu nodules	100% Cu	Up to 2 µm
Low-profile	Smaller Cu nodules	100% Cu	Up to 1 µm
High-profile	Larger Cu nodules	100% Cu	Up to 4 µm
Very High-profile	Larger Cu nodules	100% Cu	Up to 10 µm

Nodule treatments can be applied to both sides of the foil, single or Doubletreat. Nodule treated foils have an anti-tarnish treatment applied to both sides.

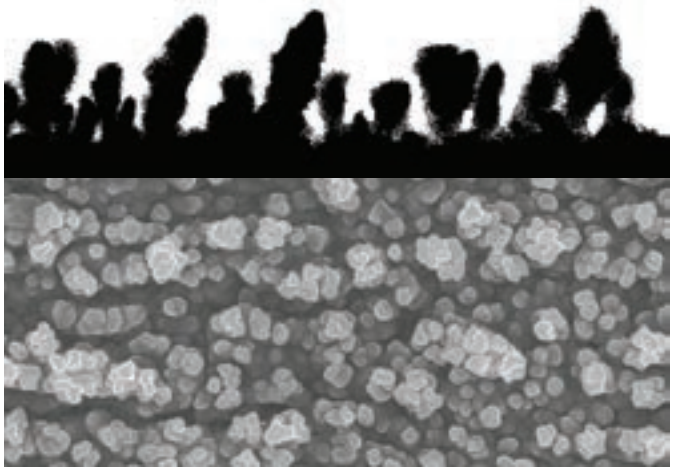
[1]Time exposure of 60 mins

Rolled Foil Benefits

Untreated Foil

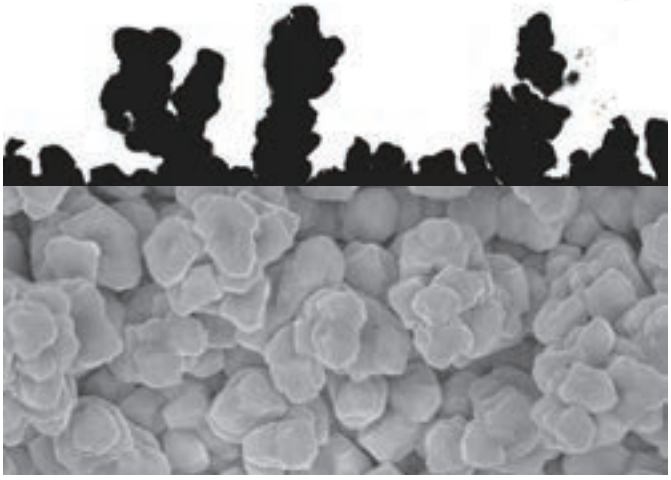
10,000x surface SEM and cross-section

Standard Pink Treatment



10,000x surface SEM and cross-section

High-Profile Treatment

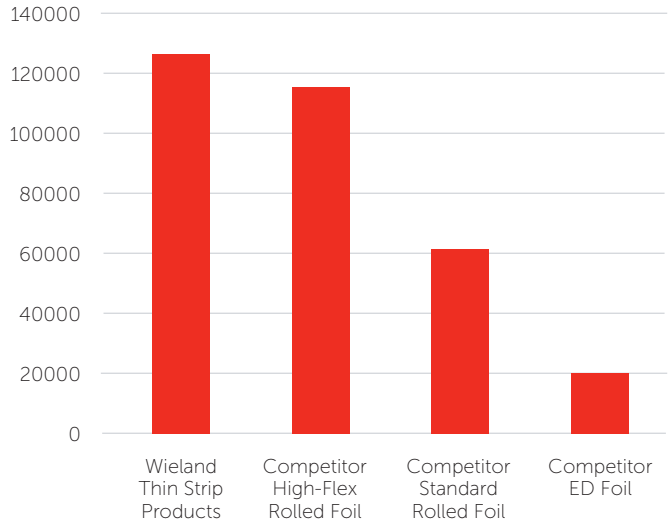


10,000x surface SEM and cross-section

Copperbond foil: Low Strain— high-flex superiority

The fatigue performance of our 1/2oz foil using a ductility flex test with a 6.35mm mandrel per IPC-TM 650 shows elevated performance when used in flex and flex to ridge PCB application.

With compartment miniaturization and demands for thinner capable foil we're positioned to support program demands.



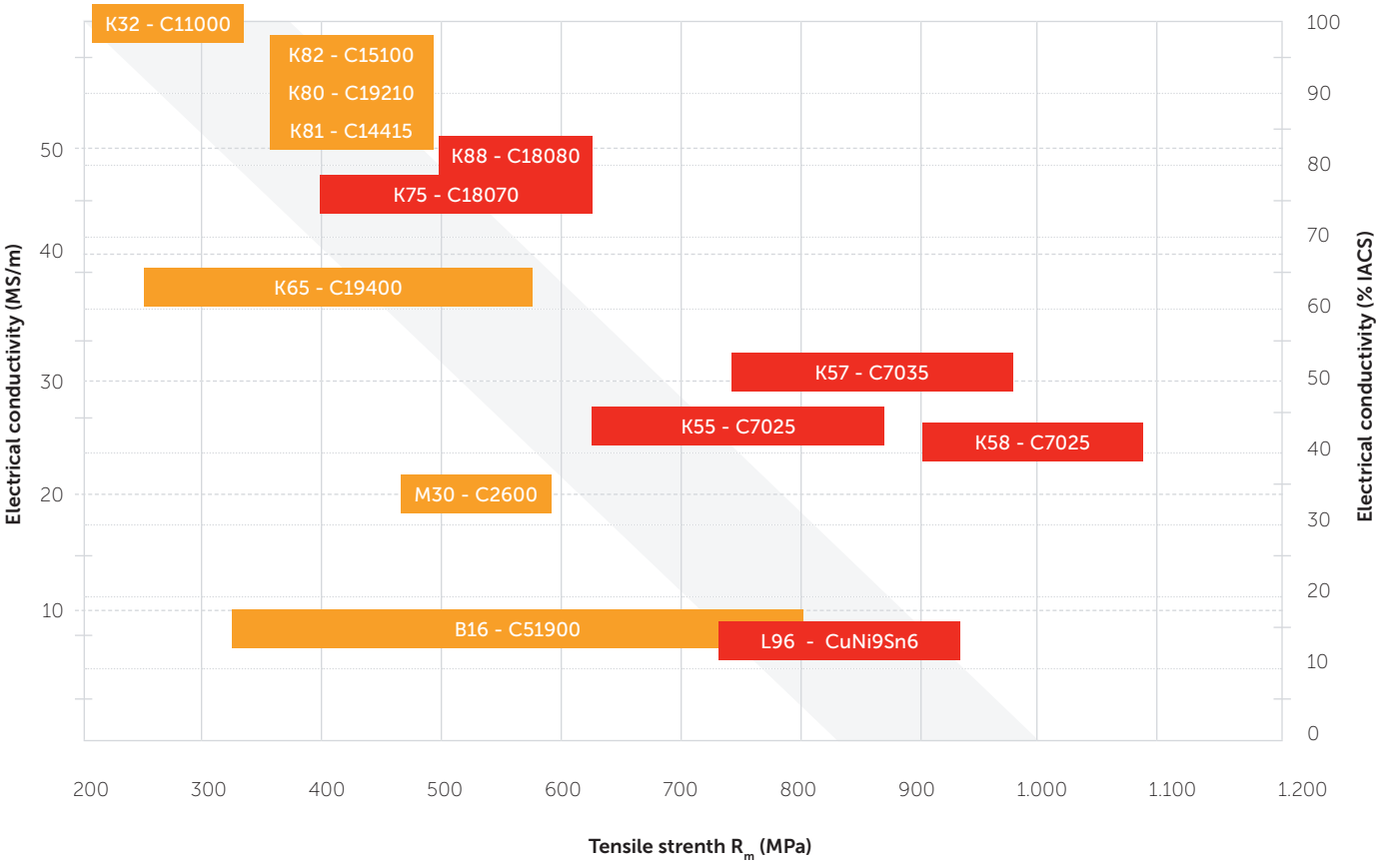
Stainless Steel Alloy Guide

Austenitic Stainless Steel															Ferritic Stainless Steel		Martensitic Stainless		PH Grade Steel
Alloy No.	201	301L	301Si	301	301H	302	304	304L [6]	304H	305	316	316L [6]	321 [6]	347 [6]	409	430	410	420	PH17-7
ASTM	A666	A666		A666		A666	A666	A666	A240	A167	A666	A666	A167	A240	A176	A176	A176	A176	A693
MIL Spec. No.				S5059		S5059	S5059	S4043			S5059		S6721	S6721					S25043
AMS Spec. No.		5517-5519	5517-5519	5517-5519	5517-5519	5516	5513	5511	5513	5514	5524	5507	5510	5512		5503	5504	5506	5528
Ni min	4.0	6.15	6.4	7.0	7.5	8.0	8.0	8.0	9.25	12.0	10.0	10.0	9.0	9.0	.50 max	.75 max	.75 max	.50 max	6.5
Cr min	16	16	16	16	16	17	18	18	18	17	16	16	17	17		16	11.5	12	16
Mo max	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.8	0.75	0.75	3.0	3.0	0.75	0.75		0.50	0.50	0.50	
C max	0.15	0.15	0.15	0.15	0.15	0.15	0.08	0.03	0.08	0.12	0.08	0.03	0.08	0.08	0.08	0.12	0.15	0.4	0.09
Mn max	7.5	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
Si max	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1
N max	0.25						0.10	0.10	0.10				0.10				0.08		
Physical Properties																			
Density (g/cm^3)	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.7	7.7	7.7	7.8
Mod. of Elasticity (Gpa)	197	193	193	193	193	193	193	193	193	193	193	193	193	193	200	200	200	200	203
Elec. Resistivity [1]	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.64x10^-7	8.88x10^-7	8.88x10^-7	8.64x10^-7	8.72x10^-7	7.20x10^-7	7.20x10^-7	6.84x10^-7	6.60x10^-7	9.60x10^-7
Therm. Conductivity [2]	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.1	16.1	16.1	15.9	—	22.7	24.9	24.9	16.4
Coef. of Therm. Expansion [3]	15.7	16.9	16.9	16.9	16.9	17.3	17.3	17.3	17.3	17.3	16.0	16.0	16.7	16.7	10.8	10.4	9.9	10.3	11.0
Cost Factor [4]	0.87			0.95		1	1	1.13		1.39	1.56	1.68	1.35	1.62	—	0.73	0.76	—	2.18
Tensile Strength (Mpa)																			
Annealed	689-930	965-1137	965-1137	758-930	689-896	517-758	620-999	620-723	620-723	551-689	551-689	551-689	551-723	551-999	379 Min	448 Min	448-655	689 Max	1034 Max
1/8 Hard	758-999			758-999	758-999	758-965	758-965	758-930	758-930	758-861	758-861	758-861				655-758			
1/4 Hard	861-1034			861-1034	861-1034	861-1034	861-1034	861-1034	861-1034	861-1034	861-1034	861-1034				758 Min			
1/2 Hard	1034-1206			1034 - 1206	1034 - 1206	1034 - 1206	1034 - 1206				1034 - 1206	1034 - 1206							
3/4 Hard	1026-1378			1026-1378	1026-1378	1026-1378	1026-1378												1241 Min (3/4c)
Full Hard	1275 Min	1275 Min	1275 Min	1275 Min	1275 Min	1275 Min	1275 Min				1206 Min	1206 Min					1378 Min (HT)	1654 Min *HT)	1378 Min (cond c)
Spring	1378 - 1585	1378 Min	1378 Min	1378 - 1585		1378 Min	1378 Min												
SPL Spring		1861 Min Note [7]	1861 Min Note [7]																
Yield Strength (Mpa)																			
Annealed	275 Min	275 Min	275 Min	241 Min	241 Min	241 Min	241 Min	206 Min	241 Min	206 Min	206 Min	206 Min	206 Min	206 Min	206 Min	241 Min	206 Min	206 Min	275 Min
1/8 Hard	379 Min			379 Min	379 Min	379 Min	379 Min	379 Min	379 Min	379 Min	379 Min	379 Min				413 Min			
1/4 Hard	517 Min			517 Min	517 Min	551 Min	551 Min	517 Min	551 Min	517 Min	517 Min	517 Min				689 Min			
1/2 Hard	758 Min			689 Min	758 Min	827 Min	827 Min				758 Min	758 Min							
3/4 Hard	930 Min			930 Min	965 Min	930 Min	930 Min												896 Min (3/4C)
Full Hard	965 Min	965 Min	965 Min	965 Min	1034 Min	999 Min	999 Min				965 Min	965 Min					1172 Min (HT)	1310 Min (HT)	965 Min (CondC)
Spring	1103 Min	1137 Min	1137 Min	1103 Min		1103 Min	1103 Min												
SPL Spring		Note [7]	Note [7]																
Elongation (% in 50.8mm)																			
Annealed	40 Min	25 Min	25 Min	40 Min	40 Min	45 Min	45 Min	40 Min	45 Min	45 Min	40 Min	40 Min	40 Min	40 Min	20 Min	20 Min	20 Min	15 Min	20 Min
1/8 Hard	30 Min			35 Min	35 Min	35 Min	35 Min	35 Min	35 Min	25 Min	30 Min	30 Min				5 Min			
1/4 Hard	25 Min			25 Min	25 Min	15 Min	15 Min	15 Min	15 Min	10 Min	10 Min	10 Min				1 Min			
1/2 Hard	15 Min			15 Min	15 Min	5 Min	5 Min				5 Min	5 Min							
3/4 Hard	7 Min			10 Min	8 Min	3 Min	3 Min												4 Min (3/4C)
Full Hard	3 Min	5 Min	5 Min	8 Min	5 Min	3 Min	1 Min				1 Min	1 Min					3 Min (HT) [5]	3 Min (HT) [5]	1 Min (CondC)
Spring	1 Min	1 Min	1 Min	1 Min		1 Min	1 Min												
SPL Spring		Note [7]	Note [7]																

Note: The above data and information is presented for design purposes and is not necessarily intended for use as purchasing specifications.

[1]CIRCULAR MIL-Ω/FT
[2]W / M °K @ 20°C
[3]PPM / °C from 20°C to 300°C (68°F to 572°F)
[4]Based On Alloy 304, Base Rice. No Extras for Gauge, Temper, Width, Quantity or Tolerance Included.
[5]Typical Heat Treated Properties Of Martensitic and PH Stainless Steels.
[6]Generally Sold In The Annealed Condition Only.
[7]Special Rolled Spring Properties Available For These Alloys.

Wieland Alloy Families



High Performance Alloys:
Solutions for your most challenging applications

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