

Etchant Selection Guide

The etchants listed in these tables are **micro etchants** designed for metallographic applications. They are mild metal etching solutions requiring a microscope to see the test result. These etchants are NOT meant for macro etching or visual inspection.

The information provided here has been compiled from our test records, published literature, and other resources. It is intended solely for informational purposes. Please note that we have NOT tested all the alloys listed in these tables. Readers are advised to conduct their own investigations to determine the suitability of the information for their specific purposes. ES Laboratory, LLC makes no representations, warranties, or conditions of any kind, whether express or implied

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Iron & Carbon Steels (General)

Name	Etchant
General microstructure (unknown grade)	First Picral then 2% Nital
Bainite	Picral
Both ferrite grains and carbides	First Picral then 2% Nital
Carbide networks	Picral
Cold-worked ferrite	2% Nital
Ferrite grains and grain boundaries	2% Nital
General alloy segregation	Picral
Grain-boundary of carbides	Picral
Granular bainite (martensite-austenite constituent)	Picral
Martensite, as-quenched	2% Nital
Martensite, tempered	First Picral then 2% Nital
Pearlite	2% Nital or Picral

Stainless Steels (General)

Name	Etchant
General microstructure (unknown grade)	Vilella's reagent
Austenite grains (austenitic stainless steel)	Electrolytic etching (best) or Marble's (aggressive)
Carbides	Vilella's reagent
Carbides, sensitized	Vilella's reagent
Delta ferrite	Vilella's
Ferrite grains (ferritic stainless steel)	Kalling's
Martensite structure	Vilella's, Fry's, or Kalling's
Sigma phase	Vilella's

Tool Steels

Alloy Name	Etchant
51100	Nital
52100	Nital
A2	Nital
A6	Nital
D2	Nital
D3	Nital
H11	Nital or Vilella's
H12	Nital
H13	Nital
H21	Nital
H46	Vilella's
L6	Nital
M2	Nital
M4	Nital
M42	Nital
M50	Nital
M52	Nital
O2	Nital
T1	Nital
T2	Nital
W1	Nital

Cast Irons

Alloy Name	Etchant
Ductile cast iron (Nodular cast iron)	Nital
Gray cast iron	Nital
Malleable cast iron	Nital
White cast iron	Nital
Wrought iron	Nital

Stainless Steels and Superalloys

Alloy Name	Etchant
301	Fry's
302	Fry's
303	Fry's
303SE	Kalling's 2
304 (18/8)	Fry's
309	Vilella's
310	Vilella's
316	Marble's
317	Marble's
321	Marble's
347	Marble's
403	Vilella's
405	Vilella's
409	Vilella's
410	Vilella's
416	Vilella's
418	Vilella's
420	Vilella's
422	Vilella's
430	Vilella's
431	Fry's
440	Vilella's
135 Mod (Nitalloy 135 Mod)	Vilella's
13-8 PH	Fry's
15-5 PH	Fry's
17-22	Vilella's
17-22A	Vilella's
17-4 PH	Fry's
17-7 PH	Fry's
21-6-9 (21Cr-6Ni-9Mn)	Fry's
22-13-5 (22Cr-13Ni-5Mn)	Fry's
300M (4340 mod)	Fry's
ASTM A182 F51 (X2CrNiMoN 22-5-3)	Superalloy Etch
A286	Fry's
AerMet (All)	Fry's
AISI 664 (V-57)	Kalling's 2
Alloy 20 (20Cb-3 stainless)	Vilella's
Alloy 901 (Nimonic 901, Pyromet 901)	Kalling's 2
Alloy 92	Fry's
AM-355 (Grade 355)	Vilella's
Chrome Core 12-FM	Kalling's 2
Chrome Core 13-FM	Kalling's 2

Chrome Core 13-XP	Kalling's 2
Chrome Core 18-FM	Kalling's 2
Chromoly (Cr<2%), such as 4100 series, P22/T22	Nital
Chromoly (high Cr), such as P91/T91	Vilella's
Colmonoy	Superalloy Etch
CK20 (Cast 310)	Marble's
CRES (corrosion-resistant steel)	Fry's
D6AC	Vilella's
Discaloy	Superalloy Etch
Duranickel 301	Acidic Ferric Chloride
Duplex 2205	S1098 Schantz
ER308	Fry's
FV535	Vilella's
Greek Ascoloy	Superalloy Etch or Vilella's
GTD222	Fry's
Hastelloy C-22	Adler's
Hastelloy C-276	Adler's
Hastelloy B, C and W	S1098 Schantz
Hastelloy X (Alloy X, Inconel HX, Pyromet 680)	Superalloy Etch
HR-120	Fry's
HP 9-4-20	Fry's
HP 9-4-30	Fry's
Hy-Tuf	Fry's
Incoloy 800 HT	Superalloy Etch
Incoloy 903	Superalloy Etch
Incoloy 907	Fry's
Incoloy 909	Superalloy Etch
Incoloy 925	Kalling's 2
Inconel 600	Superalloy Etch
Inconel 625	Adler's
Inconel 706	Kalling's 2
Inconel 713	Superalloy Etch
Inconel 718	Kalling's 2
Inconel 722	Fry's
Inconel 783	Fry's
Inconel 901	Superalloy Etch
Inconel X750	Superalloy Etch
Invar 36	Fry's
JBK-75	Fry's
Jethete	Fry's
Kanthal (FeCrAl alloy)	Kalling's 2
Kovar	Fry's
Maraging Steel	S1098 Schantz
Monel R-450	Fry's or Acidic Ferric Chloride
Monel 400 (Nickel Copper 400)	Fry's or Acidic Ferric Chloride

Monel K-500	Fry's or Acidic Ferric Chloride
N155 (Alloy N155)	Fry's
N161	Fry's
NCF 3015	Kalling's 2
Nickel 200	Kalling's 2 or Acidic Ferric Chloride
Nickel 201	Kalling's 2
Nickel 270	Acidic Ferric Chloride
Nimonic	Fry's
Nimonic C263	Superalloy Etch
Nimonic PE16	Fry's
Nitralloy	Fry's
Nitronic	Superalloy Etch
Permanickel	Acidic Ferric Chloride
Pyromet 720	Kalling's 2
Pyromet 860	Kalling's 2
Pyromet V-57	Kalling's 2
Pyrowear 675	Vilella's
Rene 77, 80, 95, 100, 125	S1098 Schantz
Sel or Sel 15	S1098 Schantz
T321 stainless	Fry's
TD-NiCr	S1098 Schantz
Thermo-Span	Fry's or Kalling's 2
TrimRite	Vilella's
Trinamet stainless	Vilella's
UDIMET 500	S1098 Schantz
UDIMET 720 (U720)	Superalloy Etch
Waspaloy	Superalloy Etch

Aluminum Alloys

Alloy Name	Etchant
206	Keller's
224	Keller's
308	Keller's
356	Keller's
357	Keller's
384	Keller's
390	Keller's
413	Keller's
520	Keller's
1100	Keller's
2219	Keller's
2618	Keller's
3003	Keller's
6061 T6	Keller's
7075	Keller's
2024 T6	Keller's
Cast aluminum (most)	Keller's

Titanium Alloys

Alloy Name	Etchant
Titanium alloys (Unknown grade)	Kroll's
Beta C	Kroll's
CP Ti (Commercially pure titanium, Grade 1-4)	Kroll's
Ti 15-3	Kroll's
Ti 21S (Beta 21S)	Kroll's
Ti 3-2.5 (Ti 3Al-2.5V, Grade 9)	Kroll's
Ti 5-2.5 (Ti 5Al-2.5Sn, Grade 6)	Kroll's
Ti 6-2-4-2 (Ti 6Al-2Sn-4Zr-2Mo)	Kroll's
Ti 6-4 (Ti 6Al-4V, Grade 5)	Kroll's
Ti 6-6-2 (Ti 6Al-6V-2Sn)	Kroll's
Alpha case detection	First Kroll's then 2% HF
Nitinol Ni-Ti alloy	Kroll's (immersion, 3+ minutes)