

Technical Information Guide: Grit Equivalency Guide & Etchants

ETCHANTS FOR IRON AND STEEL

Nital 1-10 ml HNO ₃ 90-99 ml Ethanol or Methanol	Most common etchant for Fe, Carbon and Alloy steels, Cast irons. Reveals alpha grain boundaries and constituents. The 2% solution is the most common. Use by immersion for up to 60 seconds or by swabbing. Do not store ethanolic solutions that exceed 2% nitric acid. The 5-10% solution is used for high-alloy steels should not be stored if made with ethanol. (Boylson)
Picral 4g Picric Acid 100 ml Ethanol	Recommended for structures consisting of ferrite and carbide. Does not reveal ferrite grain boundaries. Addition of 0.5-1% zephiran chloride (a commonly used antibacterial agent) improves etch rate and uniformity. Use by immersion for up to 60 seconds or by swabbing. (Igevski)
Glyceregia 3 parts HCl 2 parts Glycerol 1 part HNO ₃	For high-alloy steels, austenitic Mn steels, stainless steels and Ni-base alloys. Reveals grain structure, outlines sigma and carbides. Use fresh. Discard when turns yellow/orange. Do not store. For slower action and for martensitic or ferritic stainless steel, use 2 parts HCl. Swab sample 5-30 seconds.
Vilella's Reagent 1g Picric Acid 5 ml HCl 100 ml Ethanol	For high alloy steels and stainless steels. Use at 20°C for up to 1 minute by immersion or swabbing. Outlines constituents such as carbides, sigma phase and delta ferrite; etches martensite.

ETCHANTS FOR COPPER AND ALLOYS

25 ml NH ₄ OH 25 ml Distilled Water (optional) 25-50 ml H ₂ O ₂ (3%)	General-purpose grain-contrast etch for Cu and alloys (does not always produce grain contrast). Use fresh, add peroxide last. Use under a fume hood. Swab sample 5-45 seconds.
5g Fe(NO ₃) ₃ 25 ml HCl 70 ml Distilled Water	Excellent general-purpose etch, reveals grain boundaries well. Immerse sample 10-30 seconds. (Slepian and Prohaska)

ETCHANTS FOR ALUMINUM AND ALLOYS

0.1-10 ml HF 90-100 ml Distilled Water	General-purpose reagent. Attacks FeAl ₃ , other constituents outlined. Grain contrast usually poor. The 0.5% concentration of HF is very popular. Use by swabbing.
Keller's Reagent 2.5 ml HNO ₃ 1.5 ml HCl 1 ml HF 95 ml Distilled Water	Very popular general-purpose reagent for Al and Al alloys, except high Si alloys. Swab sample 10-20 seconds. Wash in warm water. Can follow with a dip in concentrated HNO ₃ . Outlines all common constituents, reveals grain boundaries in certain alloys.

ETCHANTS FOR NICKEL AND ALLOYS

Kalling's No. 2 2g Cu Cl ₂ 40 ml HCl 40-80 ml Ethanol	"Waterless Kalling's" for Ni-Cu, superalloys and stainless steels. Good for grain size. Swab for up to a few minutes. Can be stored.
Acetic Glyceregia 15 ml HCl 10 ml Acetic Acid 5 ml HNO ₃ 1-2 drops Glycerol (optional)	For superalloys. Use fresh. Discard when turns yellow/orange. Do not store. Swab sample 5-30 seconds.

ETCHANTS FOR TITANIUM AND ALLOYS

Kroll's Reagent 2-6 ml HNO ₃ 100 ml Distilled Water	Very good etch. Swab 3-10 seconds or immerse sample 10-30 seconds.
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Safe laboratory practices should be followed, consult MSDS of all chemicals used in etch solutions prior to use. Safety is the responsibility of the user; Buehler disclaims all liability with respect to use of these chemicals and etch solutions.

Technical Information Guide: Premium Polishing Cloths & Pads

EUROPEAN/US EQUIVANCY GUIDE

FEPA (Europe)		ANSI/CAMI (US)		
Grit Number	Micron (μm)	Grit Number	Micron (μm)	Emery Grit
P60	269.0	60	268.0	
P80	201.0	80	188.0	
P100	162.0	100	148.0	
P120	127.0	120	116.0	
P180	78.0	180	78.0	3
P240	58.5	220	66.0	2
P280	52.2	240	51.8	
P320	46.2			
P360	40.5	280	42.3	1
P400	35.0	320	34.3	0
P500	30.2	360	27.3	
P600	25.8			
P800	21.8	400	22.1	00
P1000	18.3	500	18.2	000
P1200	15.3	600	14.5	
P1500	12.6	800	12.2	0000
P2000	10.3	1000	9.2	
P2500	8.4	1200	6.5	
P4000*	5.0*			

The chart shows the midpoints for the size ranges for ANSI/CAMI graded paper according to ANSI standard B74.18-1996 and for FEPA graded paper according to FEPA standard 43-GB-1984 (R1993). The ANSI/CAMI standard lists SiC particles sizes ranges up to 600 grit paper. For finer grit ANSI/CAMI papers, the particles sizes come from the CAMI booklet, Coated Abrasive (1996).

**FEPA grades finer than P2500 are not standardized and are graded at the discretion of the manufacturer. In practice, the above standard values are only guidelines and individual manufactures may work to a different size range and mean value.*