FUTURON FORGE®

Tržiště 372/1, 118 00 Praha
EU - Czech Republic
+420 608 549 546
info@futuronforge.com

FF ELMAX CORE – Copper Liner

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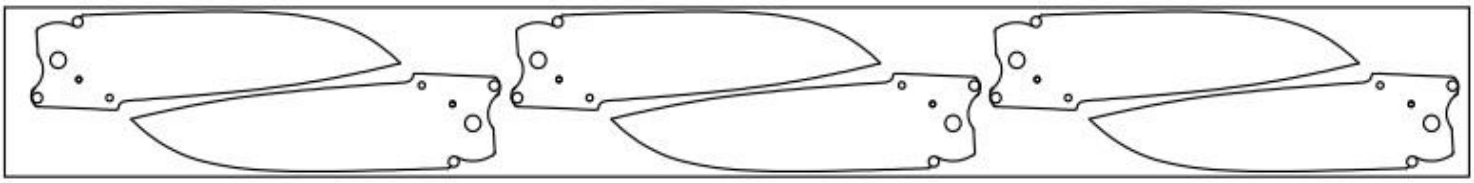
FF ELMAX Core is a san-mai stainless damascus with a UHB Elmax SuperClean core and UHB AEB-L and AISI 304 jacket. It delivers high wear and corrosion resistance, a durable edge, and strong contrast with the side layers. The copper liner adds a warm, flowing line defining the blade's overall appearance.

Steel (wt. %)	Color	C	Si	Mn	P	S	Cr	Mo	V	Ni	Cu
ELMAX	Black	1,7	0,8	0,3			18	1	3		
AEB-L	Black grey	0,65	0,4	0,65	<0,025	<0,015	12,8				
304L	Bright silver	<0,03	<0,75	<2	<0,045	<0,03	18-20			9	
Copper Liner	Copper										99.9

MACHINING

Our products are soft annealed to achieve optimal machinability, with a hardness of approximately 280 HV. You can use all conventional machining methods. Avoid cutting or shaping the material with machine shears. We recommend using a bandsaw, milling, laser cutting, or waterjet cutting. For optimal core centricity, **place the blade edge at the outer rim of the billet**. The core thickness slightly increases from the center to the edges.



MILLING/DRILLING

- Milling – monolithic carbide mill --- Vc50-60 m/min (164–197 SFM)
- For hard-milling (sizing) with monolithic carbide, mill feed up to Vc100 m/min (up to 328 SFM)
- Milling with VBD mill --- Vc75-100 m/min (246–328 SFM)
- Milling with HSS-Co mill --- Vc14-16 m/min (46–52 SFM)
- Drilling - HSS-Co drill --- Vc10-12 m/min (33–39 SFM)
- Drilling – PVD coated carbide drill ---Vc60-80 m/min (197–262 SFM).

GRINDING

You can grind our steel on all conventional types of grinders. We recommend belt-grinders or Berger grinding machines. For belt grinders, we recommend sanding belts with ceramic grains, like 3M Cubitron II; however, all ranges of conventional abrasives are usable (for example, SAIT, Klingspor, Norton, VSM, etc.). Avoid overheating (tempering) the steel while grinding. When heat-treated, it may lose the required properties.

HEAT TREATMENT

SOFT ANNEALING

Our materials are soft-annealed, and there is no need to repeat this process. Annealing is only necessary if the material will be further reforged. In such cases, the steel structure and properties are not guaranteed. The procedure is as follows:

- Protect the material before oxidation and heat in a furnace to 980°C / 1796°F
- Hold at the temperature for 2 hours at least
- Slow cooling in a furnace to 850°C / 1562°F (cooling 20°C / 68°F per hour)
- Hold at the temperature for 10 hours
- Slow cooling in a furnace until the temperature reaches 750°C / 1382°F
- Remove material from a furnace and allow slow air cooling.

HARDENING

Hardening is essential to achieve full corrosion resistance and the final hardness of the steel. The steel has to be hardened by a professional company using vacuum technology like Bodycote. Recommended hardening process:

- Preheating range: 600-850 °C / 1112-1562°F
- Austenitizing temperature: **1050 °C / 1922 °F**. Warning: Copper melts at 1084 °C (1983 °F).
- Holding time: 30 minutes
- Gas quenching (nitrogen, overpressure approx. 2 bar) down to approx. 50 °C / 122 °F
- Alternative quenching in an oil or salt bath is also possible
- Immediate cryogenic treatment at −150 to −196 °C / −302 to −384 °F for 1–3 hours is recommended, resulting in a hardness increase of approx. +1 to +3 HRC.

In case of a heat-treating failure, the material can be re-hardened only once. Multiple re-hardening cycles will cause material degradation.

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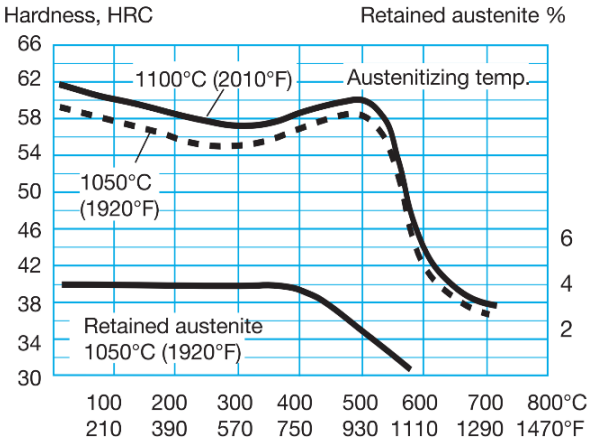
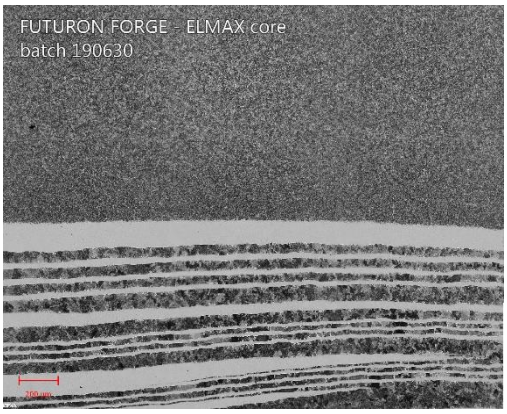
TEMPERING

Tempering have to begin as soon as possible, no later than one hour after hardening.

- For knife blades, we recommend a tempering process 2x2h 200 °C / 392°F
- To keep blade flexibility, we recommend a minimum tempering temperature 180 °C / 356°F



Tempering Graph: Elmax Core



Metallographic Analysis: Elmax Core

ETCHING

To properly contrast the damascus steel layers, etching the material (blade) is necessary.You can experiment with various etching techniques depending on your skill level. By following the steps below, you'll achieve good results.

Etchant	Solution	Concentration	Time	AEB-L	Elmax	304L	Copper
Ferric Chloride $FeCl_3$	$FeCl_3$ + Distilled water	20-25%	10-25 minutes	Black grey	Black	Bright silver	Copper

- Ensure that the blade's surface is smooth, clean, and free of scratches (etching won't hide imperfections). Finished up to 1000+ grit or polished.
- Properly degrease the blade; cleaning it in the soap-water works well.
- Before etching, test the solution on a sample piece of heat-treated material.
- Before immersing the blade, check for surface dirt in the solution. The etched part has to be degreased and clean. Do not use automatic stirrers or shaking baths during etching. The etching solution can be reused multiple times.
- After etching, neutralize the blade using Na_2CO_3 (Sodium carbonate) or $NaHCO_3$ (Baking soda). You can also use soap water and properly clean the etching residues from a blade.
- Dry the etched blade properly. We recommend spraying the blade with WD-40 (or similar) and drying again to remove any residues.
- For enhanced contrast, lightly polish the etched blade on a buffing wheel. We recommend testing this on a sample piece first.
- To make your etching solution more reactive, increase the temperature, concentration of $FeCl_3$, or add vinegar.

MARKING

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