

## APEX ULTRA

A new steel developed specifically for handmade knives. ApexUltra is a steel truly worth of handcrafted knives. It is a low alloy design that is forgeable, forge-weldable, and its fine carbides make the steel relatively easy to finish and sharpen. With its high purity and well-balanced alloy composition it has very high toughness in the 66+ HRC range along with excellent edge retention. This product offers an excellent combination of properties for knives. For more information visit:

<https://www.apexultrasteel.com/>

### Chemical Composition

Carbon	1.25%
Tungsten	2.60%
Vanadium	0.40%
Chromium	1.50%
Manganese	0.30%
Silicon	0.35%

### Thermal Treatments – Prior Processing

#### **Forging**

1120°C - 800°C

2050°F – 1475°F

Don't heat above 1120°C (2050°F)! The steel may get irreversibly damaged.

#### **Normalizing**

Heat to 950°C (1750°F), hold for 15 minutes, air cool below 600°C (1100°F).

#### **Grain Refining**

Quickly heat up to 790°C (1450°F), hold for 10 minutes, air cool.

Can be performed 2-3 times to get smaller austenite grain sizes.

#### **Annealing**

DET: Heat up to 790°C (1450°F), hold for 10-30 minutes, slow cool with 250°C (475°F) per hour until 590°C (1100°F), air cool to room temperature. Optionally the steel can be placed in a slow cool media like vermiculite.

#### **Stress Relieving**

This process is for helping with the stresses generated during grinding, which reduces warping during heat treating. It is an optional heat treating step. Heat up to 590°C (1100°F), hold for 1 hour followed by slow furnace cooling.

## Thermal Treatments – Austenitizing and Tempering

### Hardening

Austenitize between 780 °C (1435°F) and 880°C (1615°F) depending on the intended hardness, hold for 10 minutes, quench in fast oil or medium fast oil.

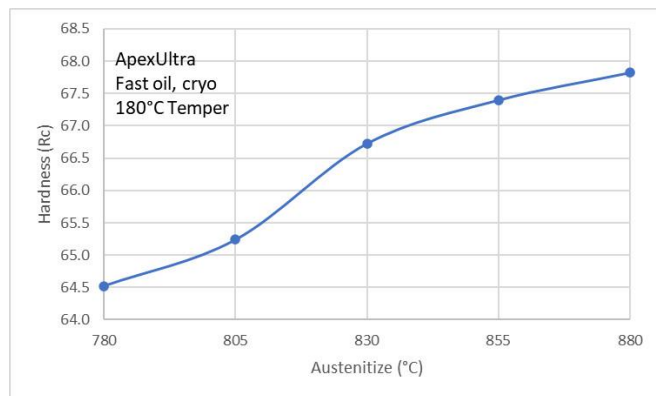
### Cold Treatment

Cold treatment is optional but helps keeping retained austenite low especially if austenitized at higher temperatures. Cool the steel immediately after quenching in the freezer, dry ice or liquid nitrogen and hold for 30 minutes.

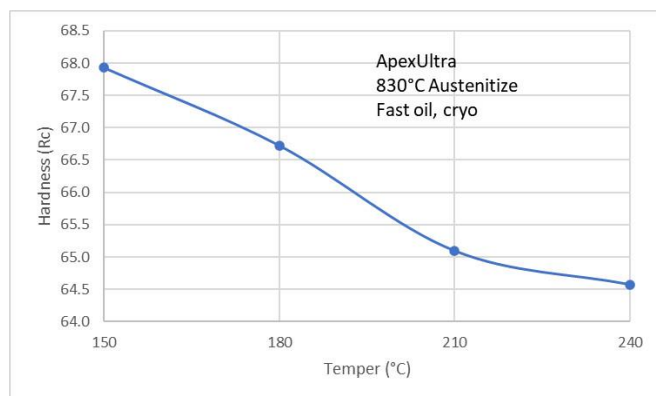
### Tempering

Heat the steel up between 150° - 240°C (300°F – 460°F) after quenching to room temperature or after cold treatment. Process the tempering two times, 1 hour each, with cooling to room temperature in between.

*Effect of Austenitizing temperature, constant tempering temperature*



*Effect of tempering temperature, constant Austenitizing temperature*



## Mechanical Properties

### Toughness / Hardness

ApexUltra has an excellent hardness / toughness ratio, especially in the high hardness range where it outperforms other steels.

*More data will follow as soon as we have finished our tests.*

### Edge Retention

ApexUltra with its combination of chromium-enriched iron carbides, tungsten carbides, and vanadium carbides, has significantly improved edge retention than other low alloy steels typically used by forging bladesmiths.

