

BILL MORAN SCHOOL OF  
**BLADESMITHING**

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# KEY TERMS & VOCABULARY

### **Alloy Steel**

A steel with elements added to enhance certain properties. For example 1060 is a simple carbon steel but 5160 is an alloy steel with chromium added for increased ability to harden.

### **Anvil**

A heavy steel or iron block with a flat top, concave sides, and typically a pointed end, on which metal can be hammered and shaped.

### **Austenite**

The phase of steel that occurs at temperatures above 1333°F, or A<sub>cm</sub> on the iron-carbon equilibrium diagram, that is a solid solution of carbon in iron. Austenite is the condition of steel when forging occurs due to its very soft, malleable and ductile nature. Austenite is nonmagnetic and was named for British metallurgist Sir W.C. Roberts Austen. All the other phases that bladesmiths make with steel result from a transformation of austenite.

### **Brittleness**

The lack of ability a material to stretch or deform before fracture.

### **Carbide**

In steel a compound of carbon with another alloying element. The most common is iron carbide (Fe<sub>3</sub>C) or cementite, but other elements in steel that form carbides include chromium, vanadium, tungsten, columbium and titanium. Carbides are much harder than the surrounding metal and their primary benefit is in increasing wear resistance but in small quantities can be a grain refiner.

### **Carbon Steel**

A steel with very limited alloying beyond its carbon content. 1060 is a simple carbon steel while 5160 is an alloy steel. This term is also often used in knife making to indicate that steel is not a stainless alloy.

### **Cementite**

The form that carbon takes in steel when it bonds with iron to form carbide ( $\text{Fe}_3\text{C}$ ). Cementite is very hard and brittle.

### **Choil**

A recessed area on the bottom side of the blade directly in front of the guard before the edge, it is often forms the bottom side of the ricasso. A choil is a natural result of drawing the edge down in forging and is useful in allowing complete access to the edge in sharpening.

### **Clip**

The areas on the spine of the blade near the tip that possesses a different angle than the rest of the spine, clips can often be sharpened or have a false edge.

### **Critical Temperature**

The temperature at which a change in crystal structure, phase or properties occurs. This can be any such temperature but is most often used by bladesmiths in reference to  $A_{c1}$ .

### **Distal Taper**

The gradual and continuous decrease in thickness of a blade moving from the guard to the tip. A blade without proper distal taper will lack balance and feel awkwardly heavy.

### **Face Centered Cubic**

The unit cell of the atomic stacking configuration of iron that is shaped like a cube with an atom at each corner and one in the center of each face. It is non-magnetic and is only stable at temperatures above 1335°F. Carbon has a very high solubility in fcc iron and austenite is a solution of carbon in fcc iron.

### **Ferrite**

The low carbon iron constituent of steel

### **Forging**

Forming of metal with dies, presses or hammers at high temperature.

### **Full Tang**

A handle attachment that has the tang of the blade exposed in a sandwich configuration between two handle slabs.

### **Fuller**

A groove down the side of a blade for the purpose of lessening weight without sacrificing strength.

### **Fullering Tool**

Also often referred to as a “fuller” itself, this is a tool used in forging to pinch in a narrow area notch or grove in the work.

### **Hardening**

The heat treatment consisting of heating a blade to put carbon into solution to make austenite and then quenching it to lock the carbon in place to make the hardened steel phase of martensite.

### **Hardness**

A measure of the steels strength, or ability to withstand deformation, a hard steel can be brittle but is not ductile.

### **Hidden Tang**

A handle attachment that involves a narrow tang hidden within the handle material.

### **Malleability**

The ability of a metal to be hammered into different shapes without breaking.

### **Martensite**

The phase present in hardened steel. Martensite is a distortion of the normal body centered atomic stacking of iron in room temperature steel into a body centered tetragonal configuration due to carbon atoms trapped within the matrix. Martensite was named for the German metallurgist Adolph Martens, and has a very distinct acicular (needle like) appearance under the microscope.



## **Metallurgy**

The branch of science and technology concerned with the properties of metals and their production and purification.

## **Normalizing**

Often confused with annealing but a distinctly different heat treatment aimed at bringing about a more homogeneous condition inside the steel. For bladesmiths normalizing consists of heating the steel as evenly as possible to a temperature to affect a desired change in carbide, austenite grain, or strain, followed by an air cool. Industry most often uses much higher temperatures for normalizing than bladesmiths, and often avoids normalizing steels that may air hardening to any degree. But for the effects of carbide and grain condition on cutting edges almost any simple steel that bladesmiths work with will benefit from normalizing.

## **Partial Tang**

A handle attachment that involves a narrow tang that only extends partially into the handle material and not passing all the way through.

## **Profile Taper**

The change in blade width from the guard to the point. On many double edge blades it decreases distally for balance and point control, but on some large chopping it can be the reverse for mass distribution in cutting.

### **Quenching**

The rapid super-cooling of austenitized steel for the purpose of hardening. Quenching requires a quenching medium (quenchant) that matches the needs of the specific steel chemistry. Quenching mediums can include brine, water, oils, air and molten salts among others.

### **Ricasso**

A squared area of the blade directly in front of the guard that has no edge.

### **Tang**

The portion of a blade that is covered by or is used for attaching the handle

### **Tempering**

The heat treatment performed on hardened steel to reduce brittleness and increase toughness. For most steels that bladesmiths use tempering temperatures will range from 350oF. to 500oF. The mechanism by which tempering works is in allowing very limited movement (diffusion) of the carbon atoms trapped in the body centered tetragonal martensite to permit a relaxation of the distortion to a more stable body centered atomic stacking. The liberated carbon then forms submicroscopic tempering carbides which will grow as temperature is increased and overall hardness decreases.

### **Vise**

A metal tool with movable jaws that are used to hold an object firmly in place while work is done on it, typically attached to a workbench.