LAKE CHARLES
WOODWORKERS CLUB

John Marcon, President

Bob Ferguson, Treas. & Newsletter Editor

JUNE 1997

MEETING HIGHLIGHTS

The May meeting was held at the Calcasieu Parish Public Library with 29 persons attending.

The president reported that the Christmas toy committee had made a recent visit to the members of the Woodworkers of Southeast Texas to obtain the toy patterns which they have found valuable in their efforts. While there, they learned that the Texas club had incorporated some time ago to equip themselves to address the liability issue. As a result, Russell Tritico, Sr., and attorney and one of our club members, spoke on the subject.

Mr. Tritico advised that, if someone injures themselves with a product of the Woodworkers Club because of negligent construction, the Club or an identifiable individual can be sued. In fact, all the members might be vulnerable to suit, if there is no corporation. With a corporation, some significant protection is provided but the liability is limited to the contents of the club treasury. Incorporation also establishes an identification for the club which could be useful in obtaining tax exempt status.

Mr. Tritico pointed out that

1. There should be no identification of the actual creator of a toy,
2. The group receiving the toys should be requested to provide the Woodworkers Club with a "Hold Harmless" statement, and
3. Our organization should make an effort to avoid problem with the products. This can be interpreted to mean careful selection of the type of product to be made which avoids hazards to children, and to establishment of a quality control function to be certain that the toys meet certain safety standards.

Following his presentation, the members present approved seeking incorporation for the club and authorized John Marcon, Bob Ferguson and Joe DeBeir to function as a committee to work with Mr. Tritico.

MAIN PRESENTATION

Rick Clark, a metallurgist, gave us a significant insight into the nature of steels, their compositions and their properties. He discussed the major properties, such as hardness, toughness, and ductility, and the techniques used to achieve a balance of them to achieve desired working properties.

Rick told us of the various ways to get hardness in steel. These included cold working, forming single phase solid solution with 1-2% of an alloy, second phase alloys with iron carbides, and interstitial alloys with hydrogen. He also discussed the properties contributed by tungsten, chromium and molybdenum and the complicated quenching procedures used to control the crystal structure of the steel.

Unfortunately, much of this information could not be translated directly into many of our typical applications. Because of the complexity of current steel alloys, making our own tools of miscellaneous "found" steel will leave much to be desired. Also, if some of our high quality cutting tools are damaged by overheating, restoring the original hardness may no longer be possible and the tool should probably be discarded.

As a complement to Rick's presentation, we are enclosing an article on metallurgy which was in a past issue of the Lee Valley newsletter.

NEXT MEETING

June 30, 1997, a Monday evening at 6:30 p.m.
A Barbeque at PPG's park on Bayou D'Inde. See the reminder on the back cover.

FUTURE MEETINGS

July 12 - Saws & Router Bits by Buddy Robinson
Aug. 9 - Lumber Grading
Sept. 13 - Finishes & Antiques
Oct. 11 - Open
Nov. 8 - Toys Work Session

Metallurgy Demystified: A Buyers' Guide to Tools

While Taiwanese tool manufacturers tout the advantages of high-carbon steel, North American suppliers are often silent about the merits of the far superior high-speed steel. Without adequate information, the unsuspecting woodworker must rely upon the promotional "facts" that manufacturers use to sell their products. The truth about the composition of a tool is not always clearly stated. For example, high-speed steel often has the same amount of carbon as high-carbon steel. And high-speed steels often contain molybdenum or tungsten as their principal alloying element, the same ingredient used in carbide tools.

As you know, higher prices are not always proportional to higher quality. So, rather than purchasing the next tool for which carbide becomes the material of choice, find out which type of a specific tool best fits your needs. To do so, you have to understand a little bit about metallurgy.

All cutting tools can cut materials of a lesser hardness — for a while. Some cutting edges stand up longer than others. This is due to a number of factors other than absolute hardness. Properties such as wear resistance, shock resistance, toughness, hardness and red hardness all affect the durability of a tool.

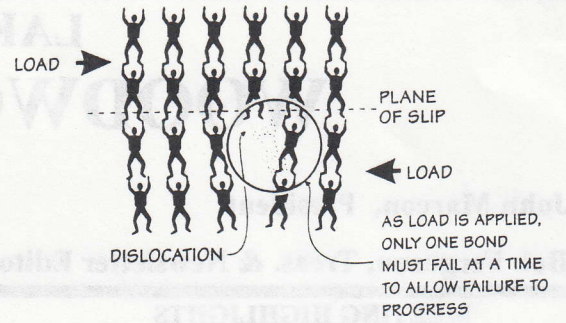
Alloying elements — carbon, nickel, chromium, vanadium, molybdenum and tungsten — affect these attributes in a variety of ways. These elements, when used in isolation or in conjunction with one another, alter the cutting characteristics. But before listing the characteristics of each of these alloys, it is important to understand how a metal behaves under load and why.

DISLOCATION THEORY (OR, WHY STEEL ISN'T MUSH)

As a metal cools, small particles form in the liquid, and eventually crystals develop in a regular, 3-D geometric pattern. But because the particles solidify randomly throughout the liquid, the crystals or grains will eventually obstruct one another and form grain boundaries. The atoms at the grain boundaries are not as well bonded to their neighbours as they are to others within the same crystal or grain.

Usually there are many breaks (called dislocations) in the neat atomic structure, which allow the atomic bonds to break in a progressive manner, each at very low forces, rather than simultaneously.

Solid metal doesn't become mush because the many dislocation lines interact with one another, impeding the progression of each dislocation. Moreover, since the slip planes of neighbouring crystals are rarely in



Dislocations — each stick man represents one atom.

exact orientation with one another, a dislocation is also stopped by a grain boundary. So, the greater the number of crystals in a given area, the greater the strength, hardness and impact resistance, all resulting in higher toughness. The promotion of fine grain size is one of the most important factors influencing toughness.

WHAT EXACTLY DO ALL THOSE ELEMENTS DO?

CARBON

Carbon, added to all steels, increases hardness (though at the expense of ductility). No cutting tools are made of low-carbon steel (< 0.3% carbon), as there would be insufficient carbon to allow hardening to any significant degree. Medium-carbon steel (0.3 - 0.6% carbon) possesses increased hardenability and toughness. High-carbon steel (0.6 - 1.2% carbon) has very good wear resistance and hardenability, but is not as tough as carbon steel with lower carbon contents. Toughness is necessary when, for instance, a drill bit encounters a hard pin knot. A high-carbon steel drill bit will have reasonable longevity between sharpenings, but if its cutting edge encounters an abrupt change in the material, it is likely to fail at that contact point.

Another drawback of high-carbon steel tools is their inability to hold an edge at elevated temperatures. Beyond 400° F, high-carbon steel begins to lose its hardness. The tips of cutting edges are often subjected to such temperatures, and once their hardness is lost, the edge breaks down in ductile failure.

NICKEL

Nickel increases toughness and impact resistance, while reducing the tendency to distort as the material is quenched during the hardening process.

VANADIUM

V

Vanadium is another alloying material that forms strong carbides. These carbides do not readily disperse into the molten steel, so as solidification progresses, grain growth is inhibited.

CHROMIUM

Cr

Chromium, when added to steel during the manufacturing process, joins with carbon to form chromium carbides. This increases the material's ability to harden, as well as its abrasion and wear resistance.

MOLYBDENUM

Mo

Like chromium, molybdenum joins with carbon to form stable carbides but resists grain growth at elevated temperatures. Consequently, fine grain size is retained. It is resistant to tempering, and promotes exceptional toughness. Although molybdenum is not as good as tungsten at promoting red hardness at very high temperatures, it costs less, and is adequate for less extreme temperatures.

TUNGSTEN

W

Tungsten is very effective at promoting the formation of stable carbides at high temperatures. When the tungsten content is more than 18%, and when it is combined with lesser percentages of chromium and vanadium, the most common formulation of high-speed steel is formed .

Such steel is made by conventional processes (melting the mixture). However, if a material can be made without some of the softer binding agents, such as iron, a greater concentration of the harder alloying elements is possible. This is how carbide, or as it is more correctly (and aptly) named, "cemented carbide" is made.

To produce tungsten carbide, tungsten powder is mixed with carbon at a ratio of approximately 94% to 6%. Small amounts of cobalt are then added, which will act as the binding element. When this powdered mixture is held under high pressures and temperatures (about 2500°F), tungsten carbide is formed, held together in a matrix of cobalt. The result is an extremely hard, but brittle, cutting material. Provided sudden shocks can be avoided, failure occurs most frequently when the lower-melting cobalt wears away, exposing poorly held carbide particles, which are apt to break off. The higher melting temperatures of tantalum and titanium make them more suitable as binding elements. They form "tantalum carbide" and "titanium carbide", which cost more.

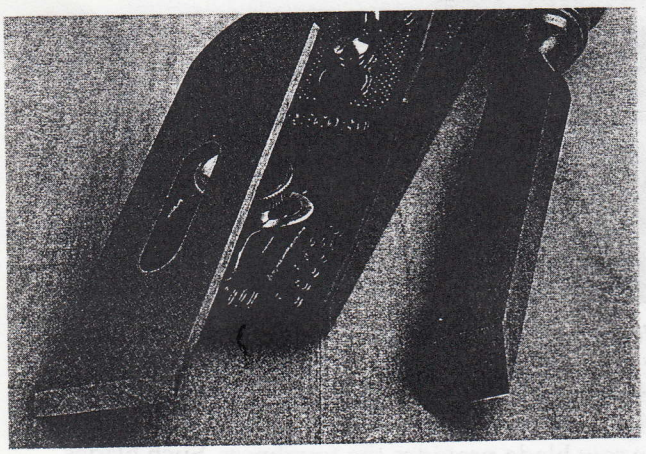
COATED CARBIDE

Coated carbide is a recent development and is produced by a very thin application of an even harder and extremely brittle alloy, to any grade of carbide. Titanium Nitride or "TIN" coating as it is often called, is the most popular hard coating, and is easily recognised by its gold colour. This vapour deposition coating is so hard that it can only be applied .0002-.0003" thick, otherwise it would fracture within itself. It must also be supported by a tougher, but very hard material, such as carbide. It is the combination of the extremely hard, thin coating, plus the substrate's ability to provide the required toughness, that makes TIN coated tools effective. The only drawback (besides the added cost) is that it is removed at the first resharpening.

ALLOYING ELEMENTS AND PROPERTIES: WHAT TOOLS NEED WHAT?

The commonly used woodworking tools listed below are grouped with other tools that have similar property requirements at their cutting edges.

CHISELS, PLANE BLADES, KNIVES AND CARVING TOOLS:



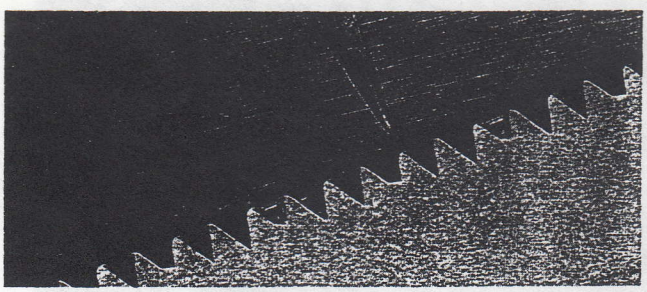
Because the cutting edges of these tools often form acute angles (15 degrees - 30 degrees), they must possess a high degree of toughness. These tools must be able to hold an edge over long use, but the keen edge must also resist fracturing under wide ranging loads. High carbon steel is the minimum requirement for these tools. Chromium or vanadium are used most often to increase toughness (some blades proudly bear a "Cr-V" stamp). Increased toughness is necessary in low-angle plane blades (as they have less material supporting the cutting edge), and on higher-angled mortise chisels (which are subjected to repeated blows). The addition of molybdenum increases toughness even further.

This alloying element is most often found in automotive tools under such names as "Molychrome". High-speed steels (and other tool steels) are the best for tools of this category, as they can be hardened to 60-64Rc (Rockwell C scale), and still possess exceptional toughness. While carbide is even harder than high-speed steels (typically 72Rc and up), it does not possess sufficient toughness at the low angles that this category of tools requires, and will fail in a brittle manner.

SAWS AND CABINET SCRAPERS

These tools must possess a high degree of hardness, as well as ductility, and so are made almost exclusively of medium to high-carbon steel (or "spring steel"). Any alloying elements other than carbon reduce ductility to the point where the blade may snap if bowed (intentionally, as a cabinet scraper is, or inadvertently, as can happen when a western push-stroke saw is forced). In general, for these types of tools, the harder the steel, the better. For example, cabinet scrapers made from high-carbon steel typically range from 38-52Rc. The harder scrapers require more effort to burnish a hook, but it will also last longer.

Because western saws cut on the push stroke, the teeth must possess both hardness and ductility, so the blade will not snap when inadvertently bowed. Traditional Japanese saws cut on the pull stroke; if binding occurs, it will be while the blade is in tension, eliminating the possibility of bending. Thus, Japanese pull-stroke saws usually have harder teeth than western saws.

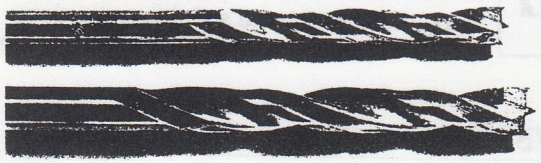


Western-style saw manufacturers now offer induction or impulse-hardened teeth. During the induction process, only the teeth are hardened to a very high degree. The tempered steel comprising the rest of the saw blade provides the toughness. Such blades exhibit a tell-tale grey or black line running the length of the blade, from the tip of the teeth to just behind the gullets.

DRILL BITS AND POWER SAW BLADES

These tools are available in everything from high-carbon steel to carbide. High-carbon steel drill bits and circular saw blades do not hold up very well to the high impact forces and temperatures to which they are subject. If you intend to use the bit or blade only once or twice (when an odd drill size is needed, or a saw-tooth pattern to cut a rarely used material), the added cost of high-speed steel or carbide may not be justified. If you are going to buy a drill bit or power saw blade of high-carbon steel, ones that have chromium, vanadium, molybdenum or tungsten are the most practical purchase.

High-speed steel bits and blades have superior toughness and red hardness, which a power tool bit or blade needs. Although not as long lasting as carbide, high-speed steel is less expensive, and can be sharpened by traditional means (e.g. aluminum oxide grinding stones). Carbide can be sharpened only with silicon carbide or diamond stones.



Carbide bits and blades last the longest. Besides their higher cost, they are susceptible to chipping; as hardness increases, toughness is reduced, and the steel becomes more brittle. If a carbide tip hits a nail, that tooth is likely to be damaged beyond repair. A high-speed bit, however, usually escapes with a small fracture, which can be easily reground.

With the exception of carbide-tipped masonry bits, carbide-tipped drill bits are not as popular as carbide-tipped circular saw blades. The rim speed of a ½" drill bit travelling at 2000 rpm is far lower than the rim speed of a 10" diameter blade travelling at similar rpm. The saw blade encounters much higher forces and temperatures, hence the need for a material that resists both.

TURNING TOOLS

High-speed steel turning tools are favoured over high-carbon steel turning tools because the work hitting the cutting edge of turning tools is moving at speeds equivalent to those of circular saw blades. Carbide-tipped wood turning tools are not very common, although carbide-tipped tools are used almost exclusively in the metal turning industry.

ROUTER BITS

Forget about buying any router bits made of regular carbon steel. At 20,000-50,000 rpm, the forces and heat generated would burn a carbon steel bit in an instant. High-speed steel that has sufficient tungsten has improved red hardness, but will not remain sharp as long as carbide will. However, for odd-shaped bits that are used only occasionally (or even once), a high-speed steel router bit may do.

(Lloyd Sevack — Engineer and Director of Research and Development at Lee Valley Tools.)

EQUIPMENT FOR SALE

ITEM NO.	DESCRIPTION	NEW PRICE	SALE PRICE
1	Scroll Saw, Craftsman, 16" Direct Drive, Model 113.236110	$120.00	$75.00
2	Disc.Belt Sander, Craftsman, 4"x36", Model 113.226424	115.00	90.00
3	4" Jointer/Planer, Craftsman, Model 149.236221	160.00	100.00
4	10" Craftsman Table Saw, Direct Drive, 20x27 Aluminum table with two extensions, Model 113.298051	300.00	200.00
5	12" Craftsman Band Saw, Model 113.243300	400.00	300.00
6	8" Grizzly Benchtop Drill Press	125.00	90.00
7	Craftsman Router, Model 315.17480, with Router Table & bits	145.00	70.00
8	3" Craftsman Belt Sander, 1 HP	65.00	40.00
9	Metal Detector, Radio Shack	200.00	100.00

Contact: Twila Mallet
1529 Sarah Dr., Lake Charles, LA
477-5449

Editor: This equipment is in good shape and represents excellent value.

EDUCATIONAL OPPORTUNITIES

The following is a partial list of the special workshops and seminars available at The Cutting Edge. If you have an interest, a more complete list can be obtained from John Marcon or by calling The Cutting Edge directly.

The CUTTING EDGE

7123 SouthWest Fwy
Just North of Bellaire Blvd
713/981-9228
www.cuttingedgetools.com

Make A Bookcase. Thursday evenings, 7 p.m. to 9:30 p.m., **June 5, 12, 19, & 26.** $200 tuition for 10 hr.. including materials. Learn to make a basic cabinet carcass using oak plywood and the biscuit joiner. This is the class for those who want to start doing their own cabinets or make built-in casework. An introductory class with a maximum of 4 students.

Segmented Bowl Design. Tuesday evenings 7 to 9:30 p.m. **June 10, 17 & 24, and 1 hr. on Saturday June 21.** $175 tuition. By popular demand, Steve will share the secrets of segmented bowl design and construction. A hands-on class for bowl turners that want to explore new options. The bowls coming out of this class have been stunning. Max. 4 students.

Make a Sofa Table. Monday evenings, 7 to 9:30 p.m. **June 16, 23, 30, & July 7.** $260 tuition for 10 hours including materials. Make a classic Mission-style sofa table with master craftsman Tom Irven. Learn how to construct fine furniture from milling the lumber to joinery techniques. The things you learn here will be used in every piece of furniture you ever build. Maximum of 4 students.

Classes are now forming and enrollment is limited. A deposit of half the tuition will hold your place for these interesting, informative and project-oriented sessions. Call for more information.

Free Saturday Tool & Technique Workshops • 11:00 a.m. to Noon • Unlimited Attendance

May 31: **Japanese Hand Tools.** Get a close-up look at these uniquely beautiful and efficient tools.
June 7: **Milling Basics.** How to take a piece of rough or warped lumber and make a usable board.
June 14: **Pen Turning Basics.** Great for gifts or to sell, see how easy pen turning can be!
June 21: **Router Basics.** See how this versatile tool is used for joinery, edge details, inlays and more!
June 28: **Incra Basics.** See how the versatile Incra line of tools make short work of complicated tasks.
July 5: **Scroll Saw Basics.** This popular saw is used to cut fretwork or patterns with ease & safety.

A PARTY

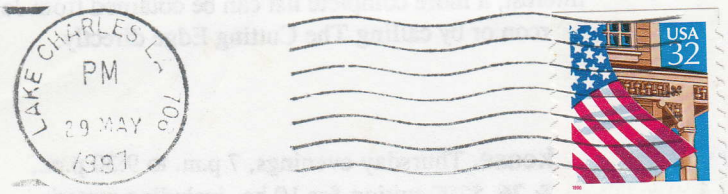
Our June meeting will be on **Monday evening, June 30**, not the second Saturday. We are going to have a picnic party for members and spouses (or guest) at the PPG picnic facility. The menu will be steaks with salad, baked potatoes, etc. at a cost of $5.00 per person . We will have a great time socializing and then learn something of leather working from Randy Stewart. There will even be some door prizes. Reservation will be absolutely necessary so that we can have enough steaks prepared.

Another notice will be mailed in two weeks calling for reservations. Watch for it and be prepared to respond. If you wish to act now, call **Barry Humphus at 478-9086** , or call one of your officers.

CHRISTMAS TOYS

The toy committee has been busy preparing for the toy program. This will be a big project for us requiring the participation of 15 - 20 workers. Many signed up at the May meeting, and they will be contacted. The plan so far is for the committee to prepare packages of oversized wooden blocks and appropriate cut-outpatterns which will be made available at the October meeting. Volunteers will be requested to cut out the toys using band or jig saws, and to perform any sanding or pre-assembly operation.

Some individuals may wish to get started earlier, so the patterns or layouts will be made available at the July meeting. The individual may be find it necessary to obtain his own lumber material. At the November meeting we will gather all contributions and do any required assembly and cleanup work.



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