M2, M4, M42 versus 10V HSS

- References:
- Cindy Drozda, http://www.cindydrozda.com/html/ToolSteel.html
- Alan Lacer, http://westbaywoodturners.com/tutorial/ToolSteel.pdf
- AAW, https://www.gulfcoastwoodturners.org/wp-content/uploads/2017/03/Tool-Steels-in-Woodturning.ppt.pdf

Before you go out and buy the Cadillac of turning tools, think of this:

So Unless You Have CBN Wheels

Only buy M2 HSS tools. The aluminum oxide wheels won't sharpen other/better/more expensive tools very well.

Sharpening

Aluminum Oxide is softer than the Carbide particles in the powdered metal used in high end gouges.

The "white" wheels that came with your grinder are low quality aluminum oxide wheels. The "Pink" wheels, and some "blue" wheels, are also Aluminum Oxide. Norton and OneWay (among others) make excellent quality Aluminum Oxide grinding wheels. They still are not capable of forming an edge on carbides, and won't give you peak performance from your powder metal tools.

Grinding

The hard carbide particles need to be sharpened with something harder than they are. If they are not, the carbide particles are not able to be formed into a part of the edge. Instead of being abraded into a sharp edge, they are knocked out of the matrix resulting in an uneven cutting edge, and end up doing very little to help the tool hold a sharp edge longer. This is why a lot of turners feel that powder metal tools don't initially get as sharp as M2 tools. They are usually not using an abrasive that will put an edge on the carbide particles.

"powder metallurgy"

10V is made using a process called "powder metallurgy", where the final product contains very fine particles of carbides.

Other powder metal tool alloys commonly found in woodturning tools are M4, and 15V. The extra hard carbide particles are what make powder metal tools hold an edge significantly longer than M2.

CBN Wheels

- CBN, Diamond, and Ceramic are harder than Carbide, and can form a sharp edge on powder metal tools
- Sharpening with fine grit seems to make more of a difference in the quality of the cutting edge on 10V than it does on M2

But wait; there is MORE!

- Grinding wheels
- 8" x 1" x 5/8“ Norton Grinding Wheel aluminum oxide; **$69.95 each + $7.49 shipping** TIMES FOUR **used during lifetime = $309.76 + the dust from dressing the wheels can cause silicosis (carcinogenic)**
- **CBN wheel = $150 or buy two for $250** and will never get dull or wear out PLUS they sharpen sharper……

Steels

- **M2**, also called High Speed Steel, or HSS, is today's standard for Woodturning tools
- **M2 HSS** is accurately heat treated according to precise specifications. Heat treating can be done poorly, or improperly. A low quality M2 tool might have the correct alloy composition, but not have the edge holding performance that it would have received from proper heat treating.

- **M42** Steel is also a conventional High Speed Steel like M2.
- **M42 has higher cobalt content than M2**, Some people feel that it holds an edge longer than M2.
- **10V**, Steel is considered a Tool Steel. It is very tough and durable. Everything that is said about the precise alloy composition and accurate heat treating of M2 applies to 10V (A11) as well. The two metals are very different, however.

Cryogenic tempering

- Cryogenic tempering takes place in a chamber, where the materials are gradually lowered in temperature. Shallow cryogenic tempering is performed at about -120ºF (-85ºC) for 10 hours or so, whereas deep cryogenic tempering takes the material below -300ºF (-185ºC) for more than 24 hours. The materials are then slowly raised to room temperature and usually annealed at about 300ºF (149ºC) for several hours. Only deep cryogenic tempering has shown to give the greatest improvement in wear resistance.

Increased wear life?

- Controlled experiments and industry experience have demonstrated that many materials benefit from this Cryo treatment. Increased wear life and better corrosion resistance, while at the same time maintaining or even improving toughness have been observed. However, few materials benefit more than tool steels. **Tool steels that are deep cryogenically treated will typically last more than 50 % longer than as quenched specimens.**