CPM 10V

It has been in the back of my mind for some time to make some test blades out of CPM 10V. I have enjoyed working with all the other Particle Metallurgy steels over the years (CPM 440V (60V), CPM 420V (90V), CPM 3V) and wanted to add this one to the list. The chemistry as listed on the data sheet indicates it has the make up for a very high performance knife blade. It has a whole bunch of vanadium and carbon to make vanadium carbide, which should pay back in excellent wear resistance and edge holding. The small amount of chromium (5%) should make it easy to air harden, but won't contribute much to corrosion resistance.

Note: this article was written in 1999, the information is a little dated but still all applicable today..

Carbon	2.45
Manganese	0.50
Silicon	0.90
Chromium	5.25
Vanadium	9.75
Molybdenum	1.30
Sulfur	0.07

I had some 10V hardened heat treat samples under the work bench and over a year they developed a very thin dusting of rust. I think that is one reason I was so slow to make a blade out of it. There is so much good blade steel around that is corrosion resistant, why spend any time on a steel that rusts just lying there? On the other hand I have talked to other makers who have used it and believe that it is the most aggressive cutting and best edge holding blade material out there. "Don't worry about corrosion," they say, "just keep it clean and polish it up once in a while" A little rust is not a bad trade off for excellent cutting performance.
I did rationalize all this and ended up finally making a test blade to use in the kitchen about a year ago. The knife was in my standard 7 inch fillet pattern, with a medium stiff blade and a green micarta handle. We all know kitchen knives get the worst treatment and most neglect of all knives in use. We can find out a lot about how a blade is going to fare the field after a short time in the kitchen. Based on an informal observation it stayed sharp longer than all the other knives

in the drawer. It currently resides in the kitchen and is always the first knife I reach for. It doesn't rust but does discolor to a dark gray patina over time.

I liked the overall performance and ended up making a few hunting and utility blades for users who want cutting and edge holding ability above everything else. I made a utility hunter for Cliff Stamp a physicist in Newfoundland Canada. He wanted a high hardness blade flat ground to a very thin edge. He was looking for the ultimate in cutting ability and edge holding. Based on my kitchen prototype I recommended CPM 10V. Cliff is a knife enthusiast and is very interested in knife performance over a wide range of conditions. He has done a very extensive set of tests on this blade. He compared it to several other knife designs and steels. The blade out performed everything it was compared to. Cliff's report is currently posted on "Blade Forums" and makes very interesting reading.

It took some work to characterize this steel and develop a heat treating recipe for it. I learned some things along the way that are worth passing on:

The steel companies sometimes clasify tool steels by the amount of chromium they have. Crucible considers 10V as a sort of supercharged A-2. They both have 5% chrome and act similar in the heat treating process. 10V has a very snappy response and a high hardness compared to 440V and 420V. The austentizing temperature is about the same as CPM420V (2100-2150 F), but the hardness after a fast air quench is 63/64. Give it one hour in Liquid Nitrogen and it comes up to a solid 64. The blade at this stage is highly stressed and close to 100% martensite. It must be tempered to yield a usable tool. Tempering at 1000 F for 2 hours for 2 cycles yields 62/63 Rockwell. I have been using blades at this high hardness without problem but a point drop would offer some insurance against edge cracking with a very thin blade geometry. Tempering at 1025 F with the same cycle above yields a final hardness of 62. I have compared a blade of this hardness with the 62/63 above and find a slight decrease in cutting and edge retention, but this wouldn't be a significant difference in the field. The bending fracture strength at this hardness is very good and the impact toughness per the Crucible data sheet is about the same as D-2 at the same hardness. The edge retention is due to the 20% of very hard (RC 85) vanadium carbide in this alloy. Needless to say with this kind of wear resistance it is very difficult to get a decent finish on 10V blades. I have been using the Norton SG or 3m Regalite belts down to 220 grit and then a 320 grit silicon carbide belt. The SC belt is good for only a couple of passes each side of the blade and it goes dead. The finish at this point is acceptable for a field grade knife blade. To get a really nice finish and maximize corrosion resistance, I have found it necessary to hand rub the blade starting with 180 silicon carbide paper and end up with 800 grit. Let me just say if you get a deep scratch in this stuff you are going to be sanding for a long time.

I wanted a wider range of feed back from users of this material, especially those who forge since my blades are all stock removal. I contacted Rick Dunkerly for more information.

Rick is a master bladesmith and well known maker of mossiac Damascus high art folding knives. Rick is also a hunting guide in the Bob Marshall Wilderness area of Montana. He uses his own knives under hunting conditions and was interested in 10V because of its advertised performance. Rich forged a blade out of 1 inch round bar. He said the steel was a little stiff to forge but not horrible. He sent it to me for final heat treating. I did some hardness tests on the "as forged" blade and found a range from 45 to 58 Rockwell. This is a very strong air hardening steel and it looks like there was some residual hardness after forging in some areas. Based on this I did an anneal cycle and the blade came back to 35 HRC everywhere. I then heat treated it using the process described above with a resulting final hardness of 62. Rich will use the blade this fall (1999) during the Montana Elk season and will compare the performance to his standard blades forged from 52100.

The edge holding is probably a little better than CPM420V. This is true primarily because of the higher attainable hardness. My comparisons have been with a 420V blade at RC 59/60 against a 10V blade of 62/63. In general hardness equals edge holding when every thing else is equal.

10V is a very specialized custom knife blade steel. It's never going to compete with the ATS34/154 CM group of work horse steels because of the lack of corrosion resistance and finish difficulties. A very few custom makers will use it for performance reasons only and it does not appear to be economically feasible for use on a factory blade. This is a steel for an avid hunter or guide who wants a blade for field dressing, skinning and boning, that cuts and holds an edge above everything else.