KNIFE GRINDERS KG

www.knifeGrinders.com.au
KG@knifeGrinders.com.au
Australia

By Vadim Kraichuk

Scanning Electron Microscope Images for Our Sharpening Protocols

SEM images are by courtesy of Todd Simpson (scienceofsharp.com)

We use two main lines of sharpening protocols: on Japanese wheels and on CBN wheels.

Our typical sharpening routine is to set the edge apex edge-leading on a grit #1000 wheel, then deburr and refine the edge on a sequence of paper wheels with progressively finer diamonds.

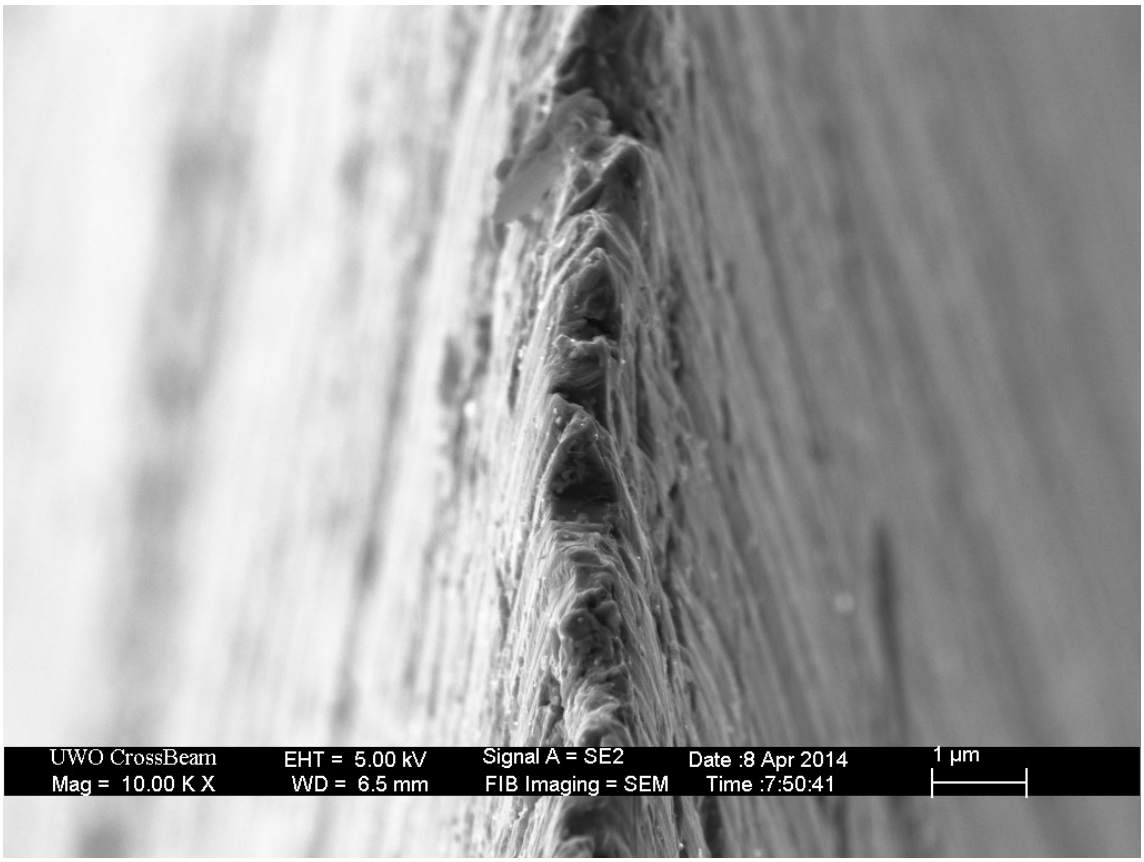
CBN/diamond superabrasives remove material in a unique way; due to their super hardness the whole process is quite similar to the milling operation, while conventional abrasives are more akin to sanding.

By SEM data, there is a great difference in the edge formation along these two lines of sharpening.

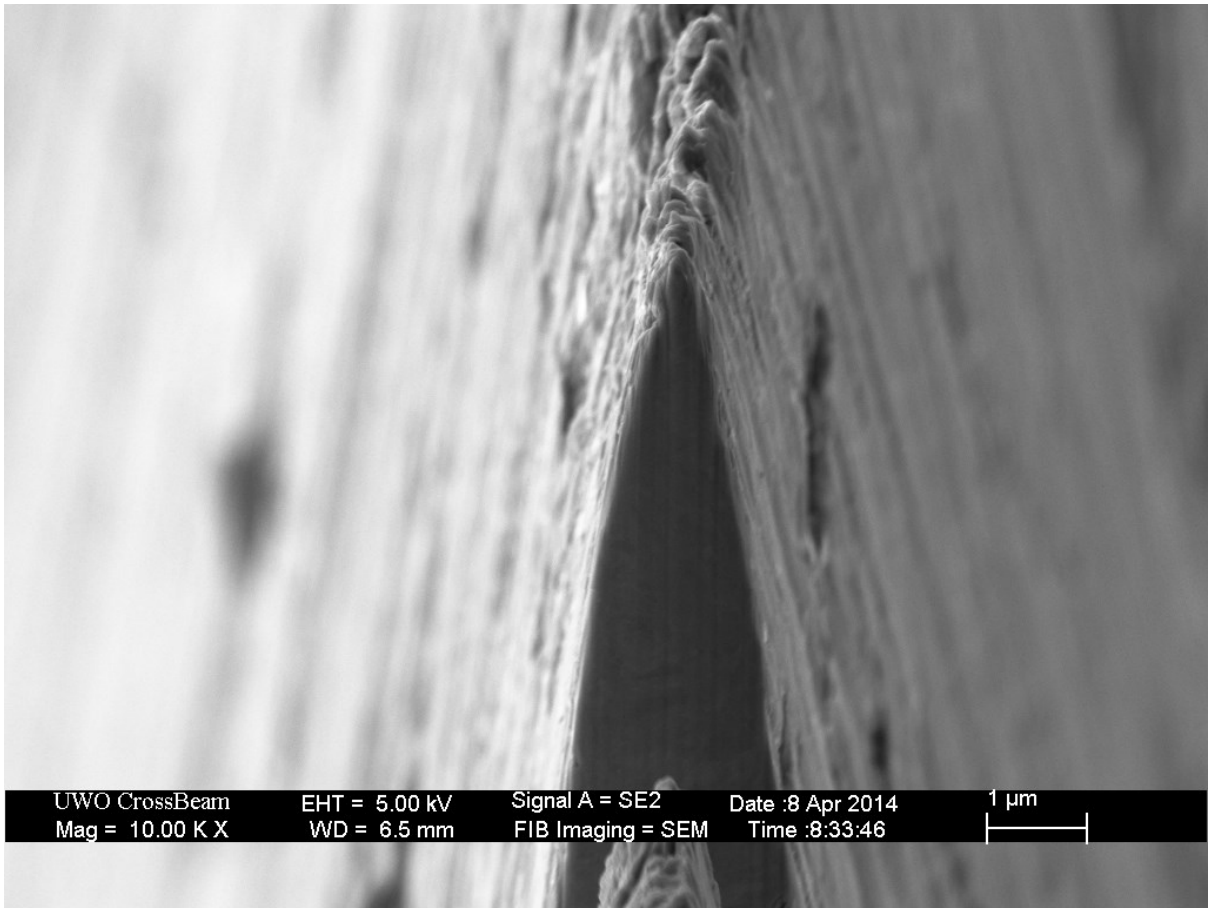
JAPANESE WHEELS

The JIS grit 800 (ISO/FEPA 1200) Japanese wheel produces an edge width in the range of **0.5 micron**, narrow and resembling isosceles triangle with little or no convexity of the bevel near the apex. There is significant variation in the apex width along the edge.

Edge-on view image of the edge set on a Japanese stone, JIS grit 1000



Focused Ion Beam (FIB) cross-section image of the same edge

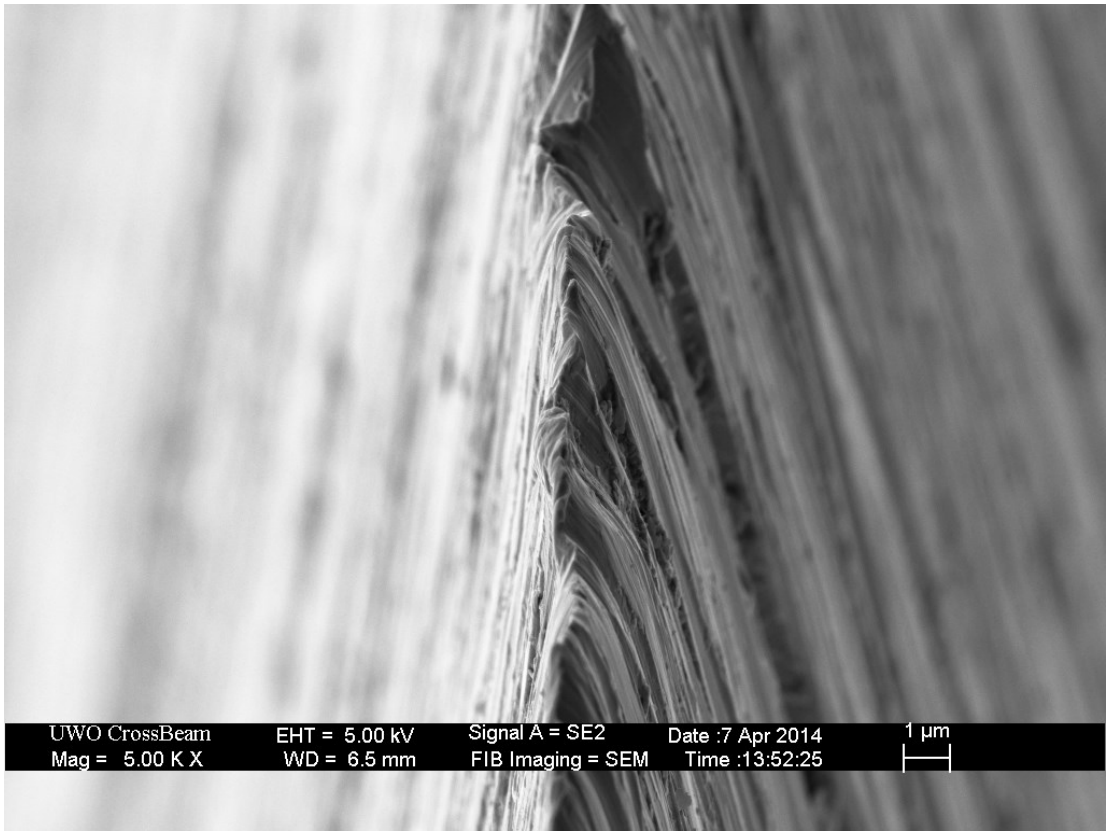


CBN WHEELS

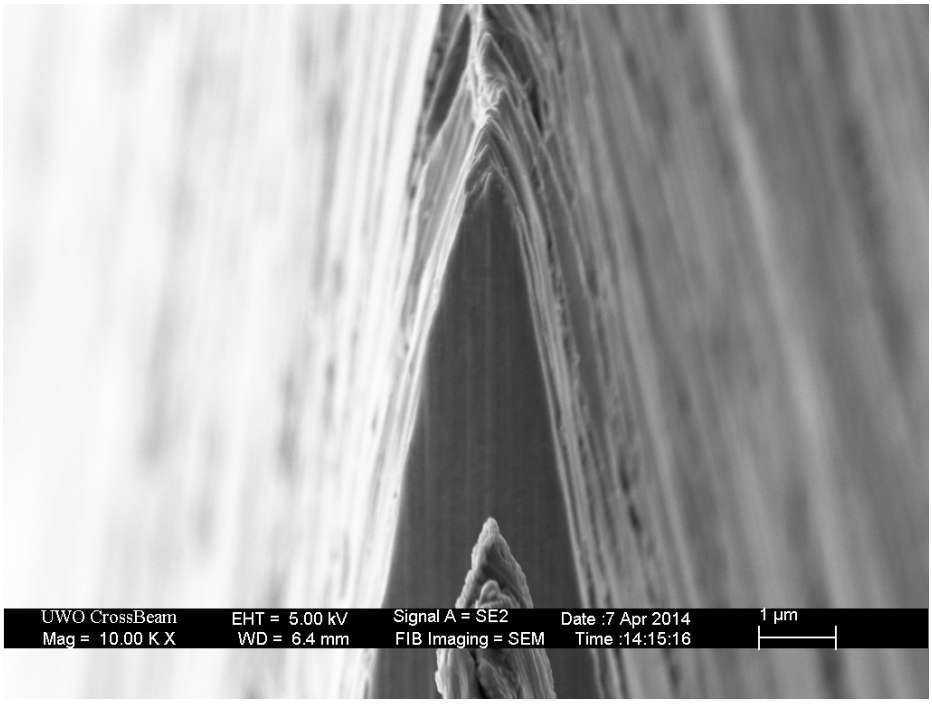
The grit 1000 (ISO/FEPA) CBN wheel produces an edge width in the range of **0.1 micron** with pronounced convexity of the bevel near the apex.

Compared to the Japanese wheels, there is less variation in the apex width along the edge.

Edge-on view image of the edge set on a diamond plate, grit 1000 (ISO/FEPA)



Focused Ion Beam (FIB) cross-section image of the same edge



This difference effects the way we refine the edge on paper wheels with diamond paste in the next step of our sharpening protocol.

After the Japanese wheel we hone at +0.4 degree more than the edge angle to sharpen the apex further (e.g. the edge that we set at 15 degree per side on the Japanese wheel will be honed at 15.4 degree).

The CBN wheel already gives a razor sharp edge. After the CBN wheel we hone at -0.1 degree less than the edge angle in order not to abrade off the sharp apex (e.g. the edge that we set at 15 degree per side on the CBN wheel will be honed at 14.9 degree).

A priory we thought coarser grits give a thicker edge, and the purpose of working the edge through progressively finer grits is to thin the edge to make it sharper. That turned out to be an errancy.

Having studied through the SEM images, it dawned upon us that the edge off #1000 CBN wheel often well below 0.1 micron is already there - 0.1 micron is a DE safety razor edge as we know. Our desired sharpness is already there; we only have to deburr cleanly without rounding the very apex, and expose that 0.1 micron edge that is there already.

Having improved our sharpening protocols based on SEM data studies, we now steadily get the same edge sharpness as the best DE safety razors.

For quality mainstream steel, the edge sharpness is near 50 BESS or near 0.1 micron edge apex width.

For premium high-end steel, the edge sharpness is near 25 BESS or 0.05 micron edge apex width – twice sharper than Gillette razor.

For our deburring methods see the ***Knife Deburring book***.