A theory of how the WE diamond pastes work

Posted by mark76 - 01 Apr 2012 15:06

When I first saw Tom's microscope photographs of the edge of a knife after stropping with the 14 micron and 10 micron diamond pastes I was baffled. I was it again when I was able to repeat this myself. Even though the edge got very smooth and sharp, there were only tiny scratches caused by the pastes. How could pastes that were so little abrasive create such smooth edges, both on balsa and on leather?

I did some additional experiments and a bit of thinking. I think I now know why it was so difficult for me to comprehend how the diamond pastes work: I was trying to explain what I saw through the microscope in terms of assumptions I held about why stropping with the diamond compounds worked:

- Leather has a stiction that causes it to burnish the edge, i.e. smear out metal over a larger area that causes scratches to become less wide and less deep or sometimes even to disappear.
- The diamond pastes are abrasive because they remove metal by making lots of scratches with a width and a depth of their specified micron size (or a little lower, since only a part of every diamond particle would touch the edge).
- The diamond pastes work on leather due to the dual effects of burnishing and abrasion.
- The diamond pastes work on balsa due to abrasion.

Tom had already shown that the second assumption was likely not true. It dawned on me when I saw with my own eyes that the first assumption was not true either. The additional experiments and thinking showed that all four assumptions are wrong!

Yet these pastes do work. So I tried to come up with an alternative explanation. You can read it in full on my blog
. But in short I think the following is happening:

- Both the balsa and the leather strops are hardly abrasive by themselves. They do not cause much burnishing by themselves either.
- The strops become effective when loaded with the diamond pastes.
- The diamond pastes cause a lot of burnishing, but hardly any abrasion.

It is the pastes that do the work, not the strops. And these pastes are hardly abrasive, but have a strong burnishing power.

==========

Re: A theory of how the WE diamond pastes work

Posted by KenSchwartz - 12 Apr 2012 13:46

Clay, I have to compliment you on doing some OUTSTANDING work demonstrating the capabilities of Nanocloth and Kangaroo.

I also want to make the point that using the WEPS platform to do this testing is a match made in heaven and a testament to what precise sharpening is all about!

Those micrographs are STUNNING and demonstrate beautifully what I've been saying about these compounds and strops and the importance as you get finer compounds of the effects of the substrate on masking the effects of the compound.

I hope you don't mind if I quote your work and use these pictures elsewhere to further promote your work and the products on the WEPS platform.

I could more obviously see that getting a 'pure effect' or compound only effect was critical at the higher grit levels like eighth and tenth micron snd finer, but your quarter micron pics strongly suggest that the nanocloth and 'roo may have additional benefits at even lower grits, possibly well below 1 micron. So I'm anxiously looking forward to the additional work on the coarser compounds I sent you with the additional nanocloth samples.

Using a surface that is smooth beyond the limits of light microscopy as a starting point for demonstrating other abrasive preps like the 10k Chocera is also a SUPERB way to demonstrate the scratch pattern of that stone without the confusion of residual coarser scratches. Again NICELY Done!!

Now when we go beyond eighth micron down to 0.025 microns we are talking about a particle the size of a small virus, so I suspect that the resultant scratch pattern will also be beyond the limits of ANY light microscope. Yet we may well see some differentiating characteristics in the way the light gets reflected from these surfaces using your current equipment. Something like the effect that you see using an ultrafine graticule as a prism (just wildly speculating here about what to look for) like you see doing spectroscopy. Perhaps a high resolution mirror effect visible at full magnification. Can't wait to see the results!

Very exciting work, Clay!

Ken

==========

Re: A theory of how the WE diamond pastes work
Posted by leomitch - 12 Apr 2012 14:00

_____

+1!!! My mouth is hanging agape with awe at what the 'Roo and Nano cloth did Clay! Startling microphotographs! I got to get me some of that Roo and Nano-cloth!

Leo

==========

Re: A theory of how the WE diamond pastes work
Posted by razoredgeknives - 12 Apr 2012 14:08

_____

holymolar wrote:

What is HHT?

Horse Hair Top?

Hanging Hair Test... its commonly used among straight razor users as a "gauge" on how responsive an edge is to push cutting.

==========

Re: A theory of how the WE diamond pastes work
Posted by PhilipPasteur - 12 Apr 2012 14:57

_____

holymolar wrote:

What is HHT?

Horse Hair Top?

Holymolar,

This is an interesting read on the HHT:

www.coticule.be/hanging-hair-test.html

Phil

==========

Re: A theory of how the WE diamond pastes work

Posted by wickededge - 12 Apr 2012 15:50

Nice link Phil, thanks for posting!

PhilipPasteur wrote:

holymolar wrote:

What is HHT?

Horse Hair Top?

Holymolar,

This is an interesting read on the HHT:

www.coticule.be/hanging-hair-test.html

Phil

==========

Re: A theory of how the WE diamond pastes work

Posted by mark76 - 12 Apr 2012 16:05

---

wickededge wrote:

After all this, I find myself wanting to do a massive cutting comparison of identical blades with different finishes! What I'd really like to do is develop a matrix that helps us to pinpoint exactly which finish is best suited for a given application both from a performance standpoint and from a durability standpoint.

Another big factor is ease of maintenance. I think a lot of the fun of the Wicked Edge platform at this level is the ease with which one can experiment and contemplate the exact best geometry and finish to apply to a given knife. Lots to explore...

This is what I like so much about the Wicked Edge AND the community surrounding it. The WEPS is a great tool for precision sharpening, allowing for exact, fast and reproducible edge setting and maintenance. But what really does it for me is the active group of people interested in getting an edge as sharp as possible (or the best edge for a particular job), sharing their experiences, posting photographs, giving their opinions and sometimes doing experiments. It's FUN!

==========