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.

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

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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.

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

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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

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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

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Re: A theory of how the WE diamond pastes work

Posted by mark76 - 12 Apr 2012 16:05

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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!

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Re: A theory of how the WE diamond pastes work

Posted by razoredgeknives - 19 Apr 2012 17:56

Clay, any word on when you will have the nanocloth and kangaroo leather listed on the site?

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Re: A theory of how the WE diamond pastes work
Posted by wickededge - 19 Apr 2012 20:39

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razoredgeknives wrote:

Clay, any word on when you will have the nanocloth and kangaroo leather listed on the site?

I'll be connecting with Ken tomorrow and hopefully we can list them in the next few days.

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Re: A theory of how the WE diamond pastes work
Posted by wickededge - 29 Oct 2012 15:22

I've finally captured a photo I've been chasing for a while. Here at 2000x we can get a nice clear view of what burnishing looks like. In the photo below, you can see how the metal on the ridges of the scratches has been moved over to fill in some of the valleys. This was done with the strops:

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Re: A theory of how the WE diamond pastes work
Posted by cbwx34 - 29 Oct 2012 15:43

Pretty cool... looks like it might be happening even more near the top of the photo.

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Re: A theory of how the WE diamond pastes work
Posted by PhilipPasteur - 29 Oct 2012 20:20

Clay,

You know that I have been at least a bit skeptical about burnishing with leather on steel...

OK, so take this from that perspective. That piece of something in the micrograph looks like it is something stuck on the blade... and at 2500X it is extremely small. For burnishing to have a major effect at the edge, would you not have to see much more of a general "smearing" or flowing of

metal. It does look like there is some other evidence, but most certainly very, very minute amounts of material bridging scratches...

You may be right, but from this one photo, I am not quite convinced... that burnishing is what we are seeing.

I do try to have an open mind on these things... so convince me

Phil

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Re: A theory of how the WE diamond pastes work

Posted by wickededge - 30 Oct 2012 00:10

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Okay
I'll try to get some better pictures of it. In that one section the metal is smeared across those scratches, filling in the valley. It may be easier to show if I start with a slightly rougher surface. Stuff to work on...

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