# A theory of how the WE diamond pastes work

Posted by mark76 - 01 Apr 2012 15:06

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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 wickededge - 02 Apr 2012 16:20

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After getting the edge to 3.5 microns, I then went back to the polishing tapes:

**510x** - 3000 grit polishing tapes after 3.5 micron strops

**510x** - 7000 grit polishing tapes after 3000 grit tapes after 3.5 micron strops

I need to do a lot more work playing with the polishing tapes!

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# Re: A theory of how the WE diamond pastes work

Posted by wickededge - 02 Apr 2012 16:29

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Next I decided to try 3.5 micron balsa strops to compare with the 3.5 micron leather strops:

I first went to the 3.5 micron balsa strops right after the 7000 grit tapes

**510x** - 3.5 micron diamond and balsa strops after 7000 grit polishing tapes

Then I went to the 3.5 micron leather strops right after the 3.5 micron balsa strops

**510x** - 3.5 micron leather strops after 3.5 micron balsa strops

Then I went back to the 3.5 balsa strops

**510x** - 3.5 micron balsa strops after 3.5 micron leather strops - 2nd pass

Then back to the 3.5 leather strops

**510x** - 3.5 micron leather strops after 3.5 micron balsa strops - 2nd pass

It looks like there is a clear difference in finish between balsa and leather.

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## Re: A theory of how the WE diamond pastes work

Posted by wickededge - 02 Apr 2012 16:33

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Now on to 1 micron diamond and leather after the 3.5 micron diamond and leather:

**510x** - 1 micron diamond and leather strops after 3.5 micron diamond and leather

Looking good!

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## Re: A theory of how the WE diamond pastes work

Posted by wickededge - 02 Apr 2012 16:33

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next a whole new direction....

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## Re: A theory of how the WE diamond pastes work

Posted by wickededge - 02 Apr 2012 16:47

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Next I wanted to examine what happens when you go straight from the 1000 grit stones to a specific grit e.g. 1000 grit > 10 micron, 1000 grit > 3.5 micron and 1000 grit > 1 micron:

**510x** - 1000 grit diamond stones after 3.5 micron diamond and leather strops finish

**510x** - 10 micron diamond and leather strops after 1000 grit diamond stones

100 passes with the strops after the stones.

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## Re: A theory of how the WE diamond pastes work

Posted by wickededge - 02 Apr 2012 16:50

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After the 10 micron strops, I re-did the edge at 1000 grit diamond. Then jumped straight from the 1000 grit diamond to the 3.5 micron diamond and leather strops:

**510x** - 3.5 micron diamond and leather strops after 1000 grit diamond stones

100 passes with the strops after the stones.

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