How to obtain a mirror edge?

Posted by mark76 - 12 Jan 2012 18:21

I am about to buy the Wicked Edge system, probably from the German reseller. Living in Europe, that avoids me having to pay high import taxes and transport costs.

I'll buy at least the base package, with the 100/200 stones and the 400/600 stones, as well as a pre-drilled base, which the German guy seems to make himself. I'll likely also order the 800/1000 stones.

From there on, I'm so not sure. If I base myself on the grit table on this site, I could either get the strops with 5/3.5 micron stropping paste for polishing after sharpening at 1000 grid. And then even finer stropping stuff, if I wanted to.

Or instead I could get the 1200/1600 stones. If I wanted to do stropping afterwards, I'd have to start with 1 micron stropping spray (since 1600 grit translates to 2.85 microns). And again, I could go even lower if I wanted to.

My goal would be really to obtain a mirror edge. Which of the two approaches would you recommend? Start stropping after the 1000 grid stones or also use the 1200/1600 stones? Is stropping even necessary after using the 1600 stones?

In this respect I am a bit confused by the video in which Clay sharpens a knife with a somewhat convex edge (the CRK Sebenza – which I own and want to sharpen to perfection) and starts stropping already at 10 microns (presumably after finally sharpening at 800 or 1000 grid) and then moves down to "only" 5 microns. Using this he is able to get a mirror finish. But according to some other messages you need stropping at smaller micron sizes for a mirror edge.

So basically my questions boil down to: if I want to obtain a mirror edge, what would I do after having sharpened my knife on a 1000 grid diamond stone:

* Start stropping at 5 microns, then 3.5 microns and possibly even less microns, e.g. 1 micron?

* Continue sharpening at 1200 and 1600 grid, and then stop? (Not strop
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* Continue sharpening at 1200 and 1600 grid, and then strop at 1 micron or even lower?

* Or an entirely different strategy, for example what Craig showed in his Sebenza video?

And a related question: how far do you need to go with sharpening/polishing in terms of micron size in order to get a mirror edge?

I know there are also Shosera stones out, by let's leave them out of this equation, for the time being, not to make this already complex discussion overcomplicated.

Thanks a lot for your answers!

P.S. I posted a similar message in a reply in another threat. That one was quite old, so maybe that was why nobody replied. Nevertheless, sorry for posting two quite similar messages. It is just that I want to order a WE this weekend and I still need some advice.

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Re: How to obtain a mirror edge?

Posted by jendeindustries - 17 Jan 2012 19:45

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Salguod wrote:

Thanks for the answer Leo! So do you think that the harder and high-tech steels like ZDP-189 are better with diamonds, and the more conventional steels are better with water-stones? Or is it more complicated than that?

Doug

Thanks for the intro, Leo!

Basically, you can make it as easy or as complicated as you like!

The grit comparison is by microns, which is the most mathematically correct way to present them without too much confusion. The size of the particle equals the size of the scratch.

Well, yes, and no. You need to take into account the friability (rate of break down) of the abrasive and binder, the action of the paste/swarf/slurry, if any, and the biggest variable - technique.

Technique first - heavier pressure is good for stock removal since it pushes the abrasives deeper into the steel, but light pressure is best for obtaining the best finishes that won't cut through the ever thinning edge of the edge. What is heavy and what is light has some defining parameters, but is ultimately different for everyone.

Action of the paste/swarf/slurry - Diamond plates are subjected more to wear-down meaning that diamonds start off with sharp jagged and pointy edges that cut aggressively. For simplicity, imagine the diamond is in the shape of a pyramid, the tip of the pyramid is sharp and pointy, but as the diamond wears, the pointed area becomes wider, with a larger surface area as time passes that doesn't cut as deeply. This is advantageous on finer grits. The dust from sharpening will also clog the surface on the plates, making less of the abrasive stick out, therefore slowing down the action as well while making it perform at a finer grit. The WEPS ceramic stones follow this same premise, only without diamonds.

Diamond paste is a different beast - it has the freedom to roll around and scrub the surface more than to scratch at depth, like the fixed diamonds on the plates. In other words, the pastes are "less" aggressive, and are better suited for polishing surfaces rather than stock removal. That's a basic answer to why the higher grit diamonds are in paste form. On leather, the softness allows for a cushion that will round the edge of the edge over, but on something a little more solid, like balsa, the pastes are more aggressive.

Choseras work on several levels - They start off using the actual grit to scratch, but as this happens, abrasive and binding agent gets released and mixes with the abraded steel particles and breaks down, forming a paste. This paste, when worked correctly can actually produce a finer grit edge than the number on the stone. Also there are burnishing effects from the metal in the paste scratching the knife's edge, creating a shinier surface. The binder is also a softer abrasive, which tends to "polish the grooves", and adds to the smoothness of an edge.

Shaptons are somewhere between the Diamonds and Choseras - they have a hard binder which scratches deeper, but they don't load up as readily (in fact, using them clean is the best). The abrasive does not get released, and there is no interaction with the binder, which leaves perfect little scratches all lined up in a row, but without polish to make it "smoother".

SO....

Diamond plates tend to make edges that are rather toothy and somewhat serrated. They pass hair cutting tests because the grooves cut into the edge are clean due to no breakdown. These edges are more aggressive.

Diamond pastes will still give your edge of the edge little serrations, which make it more "toothy".

However when you switch over to Choseras, you still get some serrations due to the large grit size breaking off the bits of the thinning edge, but the overall surface is much more consistent. These edges are smoother.

Shaptons abrade things without polishing, so you get a very cleanly defined edge with grip.

The WEPS ceramics are similar to the Shaptons, but because of the loading up, will tend to polish the grooves more, leaving a clean, but not necessarily perfect edge.

Here's a progression I did using the stock WEPS and the Choseras. You can see the differences between the diamond scratches (which are still good, mind you!) and the Chosera.

Here's one using the WEPS 600 and the Shaptons . You can see the differences between the Choseras and Shaptons here (lighting is different, though.)

I hope this helps!

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Re: How to obtain a mirror edge?
Posted by leomitch - 17 Jan 2012 20:34

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See what I told you Doug! The guy is a veritable encyclopedia on sharpening!

Good stuff Tom! Many thanks my friend!

Leo

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Re: How to obtain a mirror edge?

Posted by jendeindustries - 17 Jan 2012 23:55

Well, I forgot to answer the ZDP question

ZDP-189 - As far as I know, it is an extremely hard steel, RC 64 and abrasion resistant, so I'd go with diamonds all the way.

This is where things get even more fun. I'm not a dedicated steel junkie, so please bear with me if I mess up some of the finer details.

You have *hard* steel, and then you have *abrasion resistant* steel.

Hard steel is a result of heat treatment of a given steel, which varies greatly from knife maker to knife maker. Rockwell 60 and below is considered softer steel, and Rockwell 60 and up is considered hard steel. You can loosely apply 1/10 of the RC hardness to the Mohs scale directly, as most conventional steel is between 5 and 6 on the Mohs.

The factors that influence which sharpening medium to use here are based upon the corresponding hardness of the abrasive. Diamonds are 10 on the Mohs scale, and abrade all knife hardnesses (so far!). Silicon Carbide and Aluminum Oxide (which Shaptons and Choseras use) are in the 9's and can abrade steel every bit as well, so there is really no surface issue with these types of abrasives cutting into RC 64 steel. Sandpaper is usually feldspar, quartz or emery, which averages in the 6's on the Mohs, so there is definitely some more "evenness" between the fight of steel vs. abrasive scratching action, which can be positive in certain applications, mainly surface polishing.

The binding agents play a larger role here in determining which brand of abrasive medium to use. The general rule of thumb is a harder steel needs a softer stone, and a softer steel needs a harder stone. The softer stone allows for more abrasive to be released, thus cutting more effectively into the harder steel. On softer steel, you can easily cut through the steel with the abrasive relatively intact, so there is no real need to release abrasive at a high rate.

Diamonds negate this theory, since they still cut through everything, but then practicality enters the equation - do you really need diamonds to cut a RC55 steel? Not really, it's a little overkill, but at the same time, there is no need to ponder if it will sharpen a certain steel type.

Abrasion Resistant steels pose different problems. These use more exotic materials, usually powdered steels, which when treated, form certain carbides in the steel. Most Carbides are generally in the 9 range on the Mohs, so we have a serious competition happening for scratch ability now. Ironically abrasion resistant does not equal "Hard" as in RC 90. Because of the powdered steel, the hard carbides are essentially embedded in a matrix of "softer" steel, which can be as low as RC 55-60. On most conventional sharpening stones, you can abrade the matrix enough to produce "carbide popout" which essentially gives you a serrated edge where the carbides literally fall out, not abraded through. You can still polish the bevels, although going is very slow to get through the carbides.

Diamonds cut through everything, and on abrasion resistant steels, they are king for doing any profiling or serious repairs. Keep in mind that the fight is still there....

Bringing these abrasion resistant steel to higher refinement is also tricky - it is subject to carbide popout as you make the edge of the edge too thin for the steel to hold the carbides.

Anyway, I'm starting to ramble...

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Re: How to obtain a mirror edge?

Posted by Salguod - 18 Jan 2012 00:57

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Tom, thanks for the excellent and informative answer!

It sounds like ZDP-189 and other abrasion resistant steels might best be tackled with the WEPS by using the diamonds down to 1000 grit (7 micron) and then the 5 and 3.5 micron strops. Perhaps adding the 1 and .5 strops for a really fine mirror.

Would going "diamond all the way" like this reduce the chance of carbide popout? Because the diamonds would have a lesser chance of abrading the different hardness's unequally? And perhaps the strops (as opposed to stones) would lessen the chance of carbide popout?

Or do I have it all wrong?

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Re: How to obtain a mirror edge?

Posted by jendeindustries - 18 Jan 2012 04:57

Carbide popout is a finicky thing... even with all diamonds.

You run into several issues as you add more refinement to abrasion resistant steels. The first is that There is a point of diminishing returns with the more abrasion resistant steel - the higher you go in grit, the slower it abrades. Of course diamonds still cut, but they will progressively slow down at each grit level.

More importantly, the diamonds abrade through the carbides once the abrasive becomes smaller than the size of the actual carbides - I don't know for sure what that size is, but I am guessing somewhere between the 4K and 8K range (2-4 microns) based on my observations (which is by no means extensive in the super steel area) - In theory, this can cause carbide fracturing, where the comb-like gaps in the carbide itself become too unsupported and snap off like a pencil point, leaving you with a "whole" thickness of carbide again that is still secured to the steel. This theory seemed to be proven with my recent attempt to sharpen an s90v Spyderco military knife to shave ready. I'd get it to a certain point, where it was screaming sharp, and then the edge would disappear on me.

With the surrounding steel being rather "soft", I found that while it was difficult to abrade through the carbides, the steel itself was still rather flexible, and I could feel the edge had rolled somewhat after stropping (since I was going for a shave, I used lower angles and the edge of the edge became very thin).

The solution was to add angles to the steel as I went higher in refinement. This accounted for all the issues presented here. The higher angle allowed the carbides to be abraded through with finer grits, but left enough structural stability in the serrated carbide to not fracture. It also solved the issue of rolling the edge that was too thin for stropping. I ended up at about 35 degrees per side for my shave on the s90v.

ZDP-189 may react differently, but I think they will follow the same route.

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Re: How to obtain a mirror edge?

Posted by mark76 - 18 Jan 2012 10:28

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leomitch wrote:

See what I told you Doug! The guy is a veritable encyclopedia on sharpening!

He definitely is!

jendeindustries wrote:

I hope this helps!

It surely does! Thanks a lot, Tom. Just out of curiosity: which magnification factor do you use you microscope on to produce the photographs?

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Re: How to obtain a mirror edge?

Posted by mark76 - 18 Jan 2012 10:37

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mark76 wrote:

Just out of curiosity: which magnification factor do you use you microscope on to produce the photographs?

Ah, 400x I just read.
Thanks, Tom.

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Re: How to obtain a mirror edge?

Posted by jendeindustries - 18 Jan 2012 19:13

Anytime!

The actual size is 1mm wide by .75mm high in those pictures.

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Re: How to obtain a mirror edge?
Posted by RobertBorowski - 26 Mar 2012 23:55

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I currently own the diamonds stones up to 1000 and I am looking for an upgrade. Without saying I am looking for the best finish possible.

Just wondering if there are any thoughts on this progression:

Use the WEPS with the diamonds stones up to the 1000 then jump up to the 2000,3000 Chosera stone and then up to the 5000 10000 chosera stones.

How much of a benefit would there be with the 5000 10000 grit, Considering they are almost 200 bones. Also if it doesn't seem like a good progression I would appreciate a suggestion

My favorite knifes have ZDP189, S30v, and M390 steels (no particular order).

Thanks for the thoughts!

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Re: How to obtain a mirror edge?
Posted by jendeindustries - 27 Mar 2012 07:38

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Hi Robert! Welcome to the WEPS forum!

You say you're looking for the best finish possible - can you clarify a little more? Do you want an aesthetic super polished finish, a long lasting functional finish, or sharpener than anyone in all eleven dimensions of time and space?

Super polished include the WEPS pastes and the Choseras up to 10K. A long lasting functional edge will be the finish off the ceramic 1200 and 1600 paddles, the Chosera 2K and 3K, and the Shapton 1500 and 2K stones. Super sharp will require the Shapton 15K and 30K followed by the Hand American and Ken Schwartz compounds.

For your knives, I would be more likely to do a series of Diamond and/or CBN on balsa after the 1K WEPS diamonds. You can clean things up nicely off the 1K Diamonds first by going to the Ceramic WEPS, the Chosera 1K or the Shapton 1500.

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