



CARBOCUT: THE FIRST COMPOSITE-SPECIFIC HACKSAW

Effetto Mariposa® is devoted to providing bicycle mechanics and cyclists with the best-possible tools to work on modern bicycles.

Carbocut™ is a revolutionary hacksaw specifically designed for the bicycle world – it's the best possible tool you can have for cutting hard materials (ceramics, steel, titanium...) and it positively shines when it comes to working with composite tubes and parts.

Thanks to its grit edge tungsten carbide (WC) blade (metallurgically bonded tungsten carbide grit on a toothless metal blade), Carbocut won't damage carbon or kevlar fibers, but smoothly cut through them.



- **Composite-friendly:** cuts faster, with a better finish & no fiber damage. Gritted blades have thousands of cutting edges and cut with a 'grinding' action rather than the aggressive 'ripping' action of toothed blades, reducing the risk of debonding fibers from the matrix. The edge of a carbon tube cut with Carbocut is smooth and without sharp or uneven edges, saving the sand-paper time.
- **Smooth-cutting action & better control:** the Carbocut blade cuts both on push and pull stroke, providing more control and less vibrations. Being 19mm (3/4") tall, the blade itself is an additional guide for straight cuts. Spacers or washers might be needed to use the WC blade with some cut jigs, due to the slightly wider cut-width (1,6mm instead of 0,9 of a standard blade).
- **Durable blade:** WC blades greatly outlive standard metal toothed blades, especially when cutting difficult materials (like composites).
- **What it cuts:** composites, hard metals (hardened steel, cast iron, titanium) ceramic, and masonry. Softer materials like wood, plastics or aluminum are more easily cut with standard toothed blades.
- **Compact/easy to handle:** Carbocut accepts 10" blades, making it very compact and easy to carry in a toolbox or to use in tight spaces. Replacement 10" WC blades are available from Effetto Mariposa distributors.
- **Made with premium materials:** the Carbocut handle is made with certified aluminum (EN AB46100 alloy, no scrap-aluminum added), its frame with certified steel (Fe42) and its blade is simply extraordinary: this tool is built to last and perform. An ergonomic blade-tightening knob ensures the correct blade tension for many, perfect cuts.
- **Made in Italy.**

What is tungsten carbide?

Tungsten carbide (WC) is a chemical compound containing tungsten and carbon. Like most ceramic materials (especially carbides) it has very high hardness, high thermal/chemical resistance but, compared to metals, it's very brittle.

Measuring its hardness on the Mohs scale (see **1, page 2), WC rates 9 just below diamond (which rates 10 on the same scale, while titanium and steel rate respectively 6 and 6,5), making it a suitable material for cutting tools.

To reduce its brittleness WC is cemented: WC powder is sintered (see **2, page 2) with cobalt (a ductile metal) powder. The result is a metal-matrix composite, where cobalt (that enters the liquid stage during the process, unlike WC) embeds/cements WC grains. This composite has an higher shock resistance/toughness than WC alone, preserving most of its high hardness.

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**1: Mohs Scale (source: Wikipedia)

Friedrich Mohs (January 29, 1773 - September 29, 1839) was a German geologist/mineralogist. In 1812, using relatively common minerals, he created a hardness scale that is still used today, called the Mohs' scale of mineral hardness.

The hardness of a material is measured against the scale by finding the hardest material that the given material can scratch, and/or the softest material that can scratch the given material. The Mohs scale is a purely ordinal scale. For example, corundum (9) is twice as hard as topaz (8), but diamond (10) is almost four times as hard as corundum.

Table 1.1 shows comparison with absolute hardness.

Mohs Hardness	Mineral	Absolute Hardness
1	Talc	1
2	Gypsum	2
3	Calcite	9
4	Fluorite	21
5	Apatite	48
6	Orthoclase	72
7	Quartz	100
8	Topaz	200
9	Corundum	400
10	Diamond	1500

Table 1.1 - comparison between Mohs and Absolute hardness

On the Mohs scale, a pencil lead has a hardness of 1; a fingernail has hardness 2.5; a copper penny, about 3.5; a knife blade, 5.5; window glass, 5.5; steel file, 6.5. Using these ordinary materials of known hardness can be a simple way to approximate the position of a mineral on the scale. **Table 1.2** incorporates additional substances that may fall between levels.

Mohs Hardness	Substance or Mineral
1	Talc
2	Gypsum
2.5 to 3	Pure gold, silver, aluminum
3	Calcite, copper penny
4	Fluorite
4 to 4.5	Platinum
4 to 5	Iron
5	Apatite
6	Orthoclase
6	Titanium
6.5	Iron pyrite, steel
6 to 7	Glass, vitreous pure silica
7	Quartz
7 to 7.5	Garnet
7 to 8	Hardened steel
8	Topaz
9	Corundum
9 to 9.5	Carborundum (SiC)
<10	Ultrahard fullerite
10	Diamond
>10	Aggregated diamond nanorods

Table 1.2 – additional substances in Mohs scale

**2: Sintering

Sintering is a process that takes place at both high pressure and high temperature and is meant to create solid parts starting from powders (usually ceramic, but a mix of ceramic and metals or metals alone can be used as well).

Solid state sintering is when the heating temperature is below the melting point of the powders, liquid state sintering when at least one (but not all) element melts during the process. Cemented WC is obtained from liquid state sintering.

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