Cutting&Wear
The Hardfacing Specialist

SupaCutt Xtreme

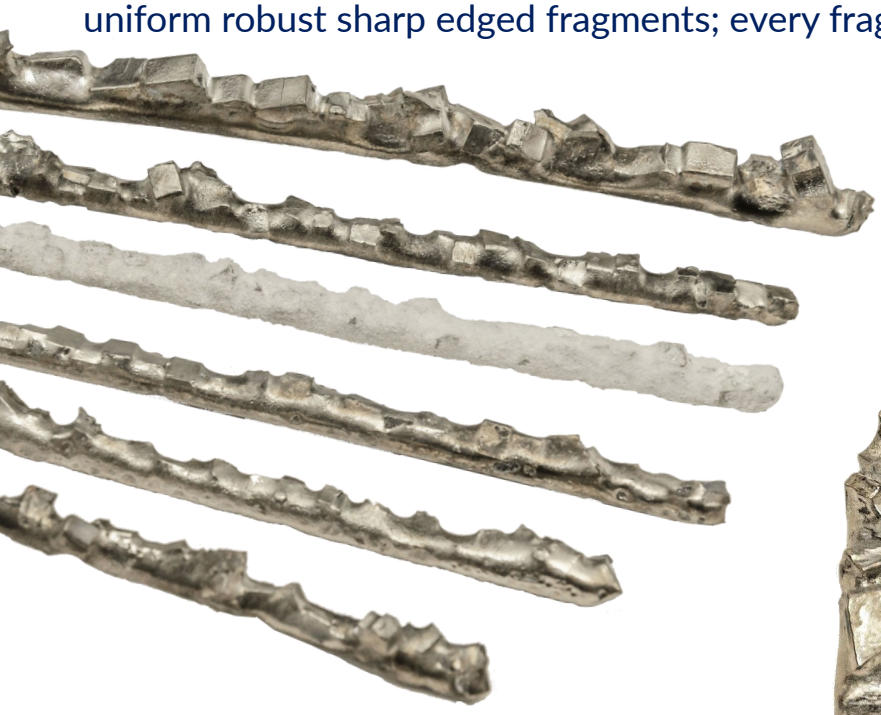
SUPACUTT Xtreme
PREMIUM COMPOSITE ROD

A step change in the manufacture of composite rod from Cutting & Wear who has been at the forefront of composite rod development for nearly 50 years.

The manufacturing process can be considered in two stages; the first being the preparation of tungsten carbide fragments and the second the manufacture of the composite rod by combining the tungsten carbide fragments with a brazing alloy.

The preparation of the tungsten carbide fragments has changed over time as tungsten carbide cutting technology has developed. The process of crushing has changed little but the process after crushing to sort the good fragments from the rest has evolved as Cutting & Wear has strived to optimise the fragment shape.

Cutting & Wear's new fragmentation process has made a major leap forward, instead of crushing the tungsten carbide inserts Cutting & Wear break the inserts into uniform robust sharp edged fragments; every fragment a perfectly shaped piece.



SupaCutt Xtreme Development

When manufacturing SupaCutt composite rod the aim is to produce sharp chunky fragments of steel cutting tungsten carbide and then combine the fragments with a high strength brazing alloy, wetting all the surfaces of the tungsten carbide with the brazing alloy.

Cutting & Wear has always used steel machining inserts which are processed to remove any coatings, crushed, graded by size and fragment shape.

Cutting & Wear also manufacture composite rods with Sharkstooth and Starcutt inserts which are purpose made shaped pieces of steel cutting tungsten carbide. These pieces are specifically shaped for optimum steel cutting performance; they are very effective but relatively expensive when compared to standard composite rod.

The challenge for Cutting & Wear was to improve the shape of the fragments produced from the steel machining inserts, to reduce the variance in performance between those and the purpose made shaped pieces.

Tungsten Carbide Grade Selection

The selection of the grade of tungsten carbide for the production of composite rod is crucial, particularly if the purpose of the composite rod is for cutting steel.

The obvious choice is to use tungsten carbide inserts which have been manufactured for steel cutting, as they have been developed for the very purpose - cutting steel. Years ago it was simple to accept steel cutting grades with the additions that enhance the steel cutting performance.

However, Titanium, Tantalum and Niobium Carbides, for example, make brazing difficult to the point where many manufactures thought it was impossible to manufacture composite rods from these grades of steel cutting tungsten carbide. If the composite rod was a wear grade for stabilizers it would not matter what grade of tungsten carbide was used, however if the composite rod was for a steel cutting mill the performance would be compromised.

Cutting & Wear have always used steel cutting grades of tungsten carbide for the production of composite rods, our composite rod production also ensures 100% wetting of the tungsten carbide.

Tungsten carbide manufactures have made more developments to enhance the steel cutting performance of their inserts. As well as incorporating different carbides in their inserts, the industry introduced coatings on the inserts. Initially nitrides and later ceramics often in multiple layers, these coatings improved cutting performance of the tungsten carbide inserts, but has created difficulties for the manufacturer of composite rod. One of the main characteristics of the coating was to prevent the steel turnings wetting the tungsten carbide and wearing the tungsten carbide inserts away, which meant brazing alloys could not wet the tungsten carbide. Initially only the uncoated inserts were used for the manufacture of composite rod, but as the proportion of coated inserts rose a method to de-coat the inserts had to be found. Fortunately the substrate grades used for the manufacture of the coated inserts still have the additional carbides to give the enhanced steel cutting performance.

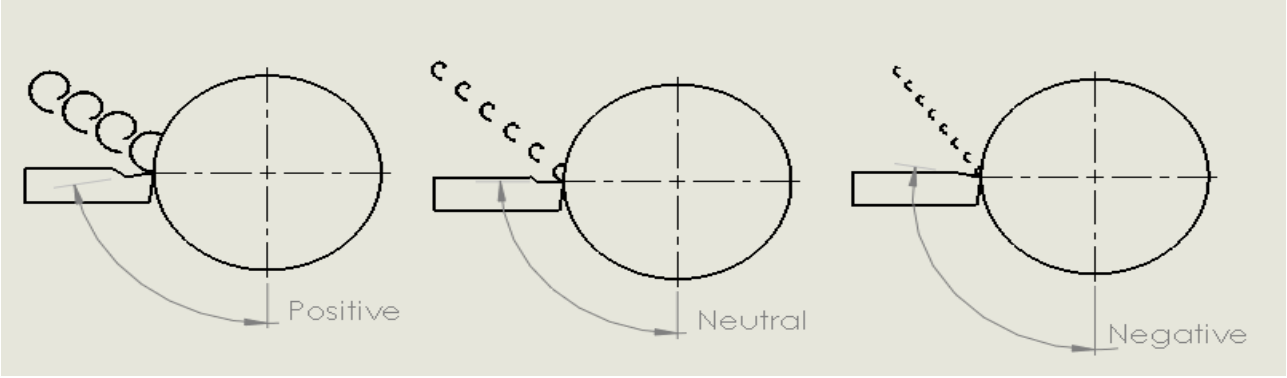
The use of a steel cutting grade of tungsten carbide does not compromise the performance of cutting formation or other metals; the relatively high hardness enhances the cutting of formation compared to a standard grade.

Cutting Geometry for Composite Rod

Consideration also has to be given to the perfect shape of the fragments of tungsten carbide used in the manufacture of composite rod for steel cutting downhole.

Composite rod produced from crushed inserts has cutting characteristics more typical of filing or grinding; SupaCutt Xtreme has been developed to cut more like a machining tool and improve the metal removal rate.

To get the best from tungsten carbide we can learn from engineering's use of tungsten carbide for machining steel, where the strength of the cutting edge is a prime consideration, therefore this pushes you to neutral and to negative rake cutting angles.



Crushed Fragments

Positive Cutting Rake

- Weak cutting edge
- Long cuttings
- Shortest life

New Fragmentation Process

Neutral Cutting Rake

- Strong cutting edge
- Short cuttings
- Long life

Negative Cutting Rake

- Strongest cutting edge
- Shortest cuttings
- Longest life

In practice when producing the fragments using the crushing process, the post crushing operation aim is to sort the strong chunky fragments from the flaky pieces; the chunky fragments generating the neutral and negative cutting geometry, the flaky pieces the weak positive cutting geometry.

Producing fragments by crushing is very inefficient and the quality of the final product is dependent on the final sorting of the crushed fragments, which is a very subjective process at best and difficult to automate.

Cutting & Wear has developed a new fragmentation process which takes the de-coated inserts, groups them together for shape, size and thickness. The inserts are then broken to a defined shape, with the size of the original inset determining the final fragment size. Producing the fragments this way ensures they are very consistent in size with strong sharp edges and corners for optimum steel cutting performance. We have seen in field trials and lab experiments that the pieces do hold gauge for longer due to this durability which in turns translates to faster cutting and longer life.

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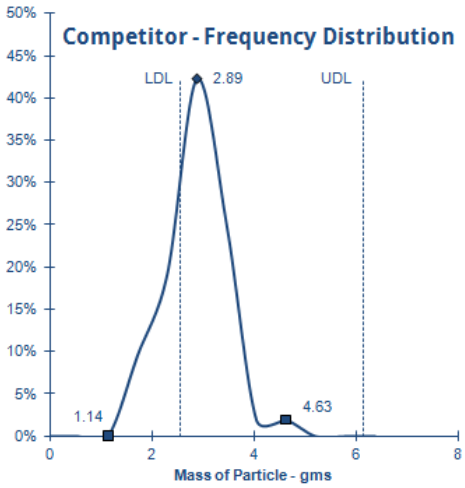
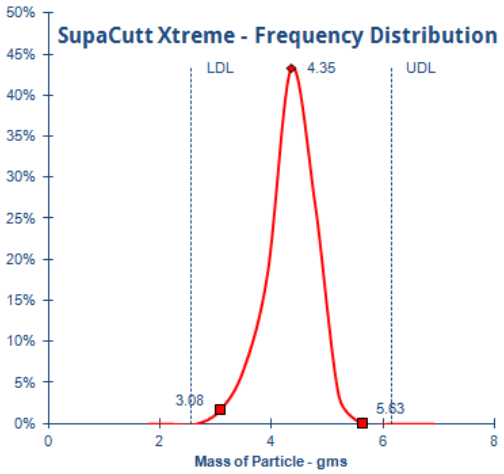
SupaCutt Xtreme Fragments

Leading competitor fragments



Supacutt Xtreme Fragments



SupaCutt Xtreme fragments are very consistent in size as shown on the distribution graph. Above 80% of the fragments being within a 10% spread of mass. The uniformity of the fragments ensures an even cutting structure with no wastage of small or over sized fragments.

Rod Production

Rod production with the new SupaCutt Xtreme fragments is a very important stage as it is crucial the fragments are 100% wetted and evenly distributed along the rod. The SupaCutt Xtreme rods are small in cross section, keeping the weight down and for rods above 3/16 sizes provides the ability to melt off one piece of carbide at a time, for precise control when laying the cutting structure. Standard matrix Nickel Bonze (Nickel Silver) is high strength, work hardening up to 100,000psi to support the fragments of the tungsten carbide in a strong shock absorbing matrix for maximum performance.

For special applications e.g. where cracking of the steel substrate is problematic we can offer a Copper Silicon matrix, but this comes with the expense of a reduction in strength. Where corrosion and erosion of the matrix is problematic, Nickel Chrome Boron matrixes are available to special order.

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SupaCutt Xtreme Application

SupaCutt Xtreme is ideal for dressing tools for milling casing where 'the robust aggressive' cutting structure can be utilised for rapid metal removal; whip-stock mills, junk mills, taper mills etc.

When laid 'randomly' SupaCutt Xtreme will produce good results for multi purpose use, an open mono layer is best when engaging formations, but for a more aggressive structure the fragments of tungsten carbide can be manually orientated for maximum cutting performance.

Note. As with all composite rods avoid laying the fragments of tungsten carbide 'flat', for best cutting performance ensure edges are exposed.

Standard SupaCutt composite rod manufactured from crushed tungsten carbide has a multiplicity of sharp but weaker cutting edges, best suited for milling difficult to cut materials which have to be ground away slowly such as inconels and high alloy steels.

Gauging and Availability

SupaCutt Xtreme Rod	1/4" 6.5mm	5/16" 8mm	3/8" 9.5mm	1/2" 12.5mm
Rod Weight	250gm 8.8oz	357gm 12.6oz	500gm 17.6oz	715gm 25.2oz
Gauge Height - Single Layer	0.310" 7.9mm	0.377" 9.6mm	0.430" 10.9mm	0.550" 14mm

All sizes available in flux coated, residual flux or bare
Available in 5kg (11lb) boxes

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Spec 7-1 Licence No. 7-1-0227

Established 1968