

Diamond Cutting Blades for Plastic Foils and Films:

Sharp, smooth as glass and extremely wear resistant

With diamond coated cutting blades, blade operating life can be extended from 20 to 40 times to that of carbide or ceramic blades. Advances in diamond coating and plasma polishing make it possible, for the first time, to manufacture cutting blades which are sharp, smooth as glass and extremely wear resistant cutting edge. Operating under the name of “Diamaze[®] -PSD-Blades”, GFD will offer users having the highest requirements in sharpness, durability and cutting speed this new generation of blades. Due to the hard diamond layer, all current materials such as plastic and metal films, paper, rubber, textiles and leathers can be cut with Diamaze blades. The award winning development was made possible through close cooperation’s with WMTech – Center of Excellence for Micro and Nano Materials at Ulm University and Cemecon AG. The results are impressive. By using Diamaze[®]-PSD-blades to cut plastic films, the blade life can be increased up to 800 times in comparison to steel blades.

Cutting blades are used in practically all technical areas. The primary applications are the cutting of plastic and metal films and paper. However, cutting blades are also the tool of choice for rubber, textiles and leather. The requirements of customers are clear: necessary are economic solutions to provide blades with long life spans and high processing speeds whereby an optimal cutting edge quality can be attained. Depending on the cutting requirement, blades made from steel, hard metal or ceramic are normally used. The demands placed on the cutting blades rise continuously as a result of added colours, titanium dioxide, fibers and composite materials in addition to ever increasing machining speeds. The blades used up until now are quickly reaching their limit, are wearing out too quickly and

becoming dull. The results: frequent and time consuming blade replacement with additional machine down time and increased quality control costs.

Here, a solution arises which has already recorded spectacular success for several years in the tool manufacturing industry with material cutting.

Thereby, carbide tools are coated with a thin and nano-crystalline diamond layer. The diamond coating possesses essentially all the advantages of its natural paradigm: pure diamond is the hardest known material and at low and middle temperatures almost completely chemically resistant.

It has an extremely small adhesion tendency compared to most materials and provides the highest known heat conductivity. The combination of these properties ensures the user a longer tool life time and, as a general rule, makes noticeably higher machining speeds possible.

These advantages can now also be used by coating cutting blades with diamond. This is made possible through a plasma sharpening process which, in effect, re-sharpens the blade after the diamond coating process.

Usually users experience a blade as being very sharp when the radius of curvature at the cutting edge is less than $1\mu\text{m}$. The plasma sharpening process (Image 1) enables the precise removal of the diamond coating in such a way that the radius of curvature can be reduced from 10 to $15\mu\text{m}$ to values of less than $0.2\mu\text{m}$. If desired, the sharpened diamond cutting edge can thereby surpass the original sharpness of the uncoated blade. This leads to lower required cutting forces, smoother cutting edges and thereby to an increase in production.

Diamaze®-PSD-Blades exhibit a significant increase in operational life

When cutting plastic films having additives out of Titanium dioxide, the new Diamaze®-PSD-Blades reach an increase in operation life from about 20-40 times in comparison to carbide blades and about 20-30 times in comparison to ceramic blades. This is sensational when one considers that ceramic and carbide blades have, until now, been viewed as the most stable blade material available. Through the significant increase in operational lifetime, Diamaze®-PSD-Blades decrease machine down time but also time and effort for quality control as the cutting properties of the blades are practically constant over a very long time period.

These Advantages become clear in practical applications. Amongst others, Diamond coated cutting blades are used in the Flexo-Film GmbH company in Holdorf, Germany in various cutting tasks. A typical use is, for example, the cutting of 45 µm thick polyethylene films with 10% titanium dioxide. A normal TiN coated steel blade lasts under these conditions approximately 3 days. However, the diamond coated cutting blades exhibited no signs of wear even after 6 months. "Next to the tremendous life time, the consistent sharpness is a large advantage of diamond coated blades", reported Mr. M. Block, extrusion supervisor from Flexo-Film GmbH. Because of these positive results, diamond coated cutting blades have also successfully been used in the last several months to cut other types of demanding foils.

When the underlying technology was awarded the "Prize for Innovative Material Applications" from the VDI (The Association of German Engineers), scarcely anybody had counted on such quick success. Because of these advancements and because of the considerable savings when used, Diamaze®-PSD-Blades are already used by other well-known industrial companies for the cutting of plastic and metal films.

Conclusion:

The new Diamaze®-PSD-Blades are distinguished ultimately by their wear resistance and sharp cutting edge and provide their users with tremendous cost advantages, efficient production and a considerable increase in quality.

Images and Captions

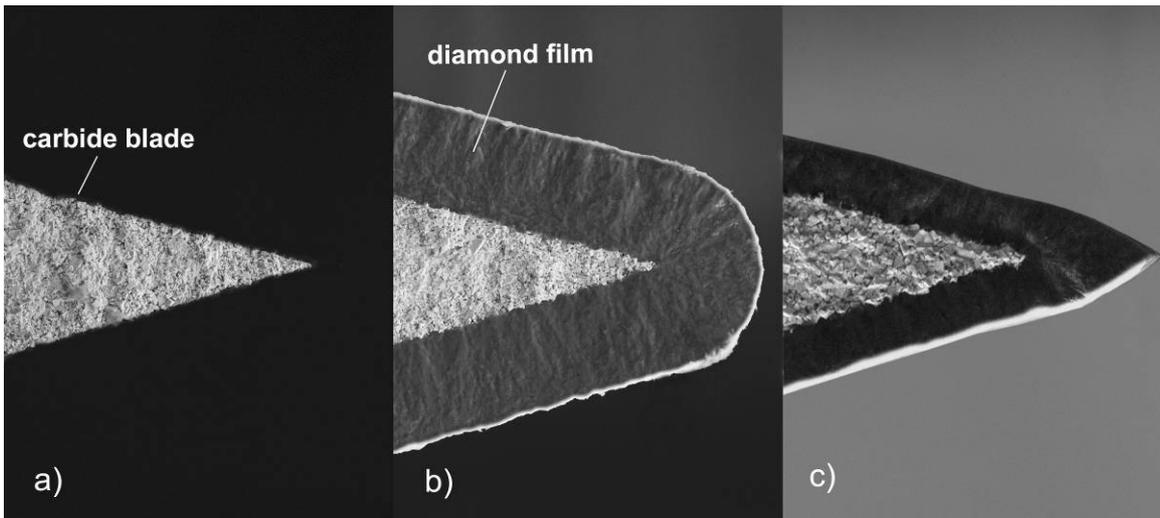


Image (1): Plasma sharpening process technique. Side view of cutting edge before coating a), after coating b) and after coating and plasma sharpening c).

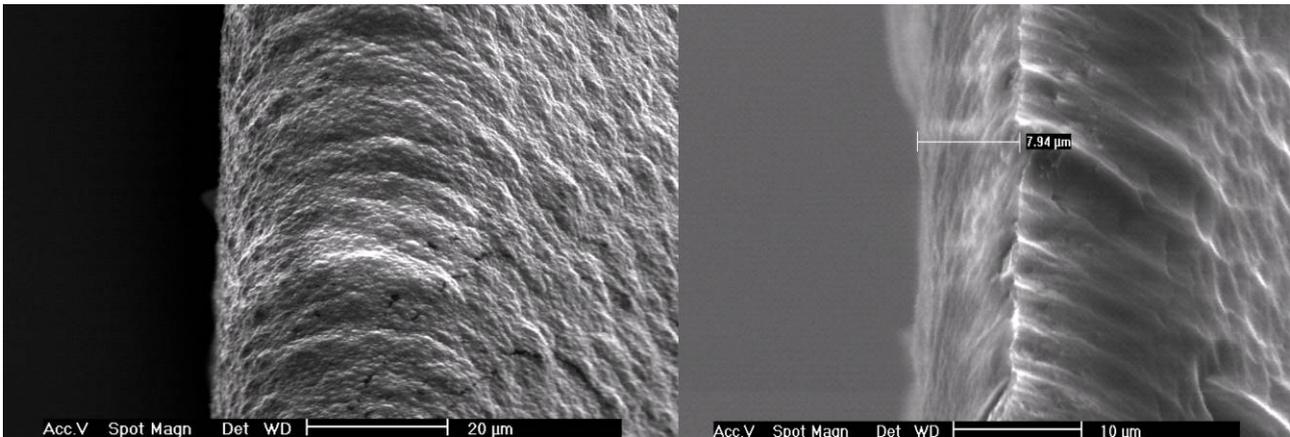


Image (2): Top view of a diamond coated cutting edge before (left) and after (right) the sharpening process.

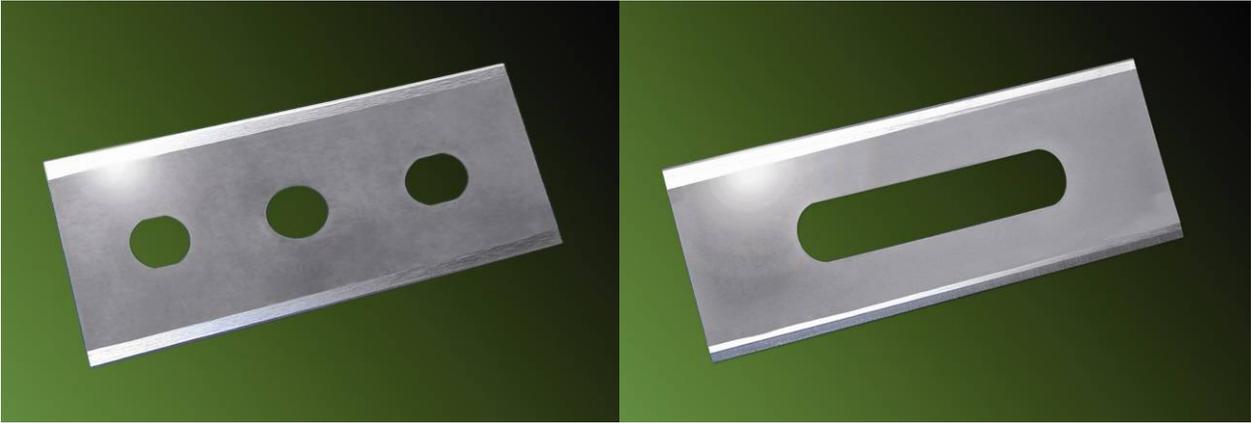


Image (3): Diamaze®-PSD cutting blades having thicknesses ranging from 0.2 mm to 0.4 mm for foil cutting.

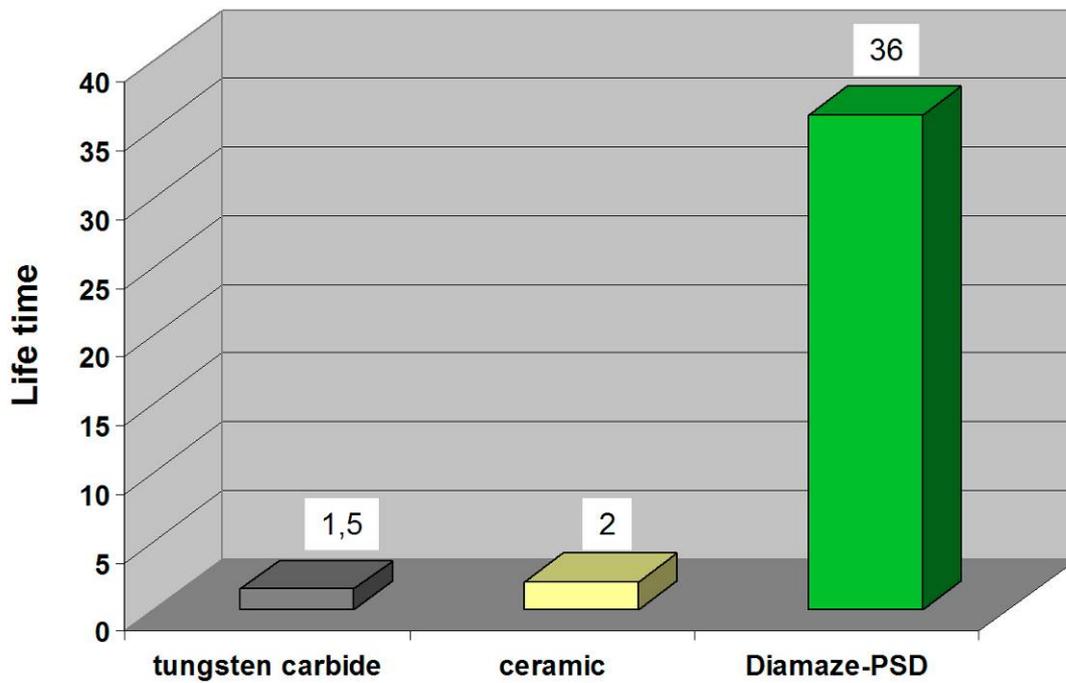


Image (4): Blade life time comparison between carbide, ceramic and Diamaze-PSD-Blades from the cutting of a plastic film containing titanium dioxide particles.

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Information about GFD Gesellschaft für Diamantprodukte mbH

Based in Ulm, GFD is the world wide leader in the production of diamond micro-parts, and in the manufacturing of diamond coated and sharpened cutting blades (Diamaze®-PSD-Blades). GFD has over 14 years of experience in diamond manufacturing and processing and over 8 years of experience in the construction and production of diamond cutting blades.

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