

SHAPE it

OSG GLOBAL TOOLING MAGAZINE | WINTER 2023

FEATURE: DIAMOND TOOLING

The strongest tools, made from the earth's hardest mineral



TECHNICAL INSIGHT

AE-LNBD-N DLC Coated
End Mill for Copper
Electrode Applications

GLOBAL REPORTS

- Italy
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- Germany

OSG NEWS

- INTERMOLD 2022
- New Taipei Office
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EMPLOYEE INTERVIEW

in Thailand

2023 - a year of decisive test for “Beyond the Limit”

A Message from the President

The initial shock of the unpredictable long-term global impact caused by the COVID-19 pandemic has now passed. The world economy has resumed economic activities amid the COVID-19 crisis and is now facing new challenges such as rising energy and material costs, inflation, and chronic shortages of goods. There is no time to stand still in such a fast-paced era.

Since the pandemic, OSG has been confronted with numerous challenges due to the sudden changes in market conditions and disruptions in the supply chain. Under such circumstances, the formulation of OSG's new medium-term management plan “Beyond the Limit 2024” and business reforms could not have been timelier. In OSG's medium-term management plan, the company aims to improve business efficiency and strengthen its corporate structure so that profits can be generated at all times. Fostering a strong corporate structure that can withstand the impact of social changes will ultimately contribute to the creation of a sustainable society in the future.

For the medium-term management plan that began from fiscal 2022, several business strategies have already been implemented. In particular, sales of “A Brand products,” which contribute to the expansion of market share, and a greater emphasis on the “micro precision sector,” which is positioned as a new strategic market, are progressing steadily. Based on these pillars, OSG sees fiscal 2023 as a critical year for the global expansion of these strategies and achieving the medium-term management plan.

To achieve new goals, one must challenge the status quo, setting no limit, and to break through conventional wisdom. There is often a tendency to resist change unless major problems arise. It is important to always have doubts regarding the existing condition. OSG will strive to continuously evolve with new innovations to provide products and services that satisfy our customers. Moving forward, OSG will make every effort to become an “essential player” (indispensable manufacturer) that contributes to the global manufacturing industry.

Lastly, I would like to wish our SHAPE IT readers a happy and prosperous new year.



A handwritten signature in black ink, appearing to read 'N. Osawa', written in a cursive style.

Nobuaki Osawa
President & COO of OSG Corporation

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SHAPE IT is a global cutting tool magazine published by OSG Corporation.

Publication Date: January 2023

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Diamond Tooling

The strongest tools, made from the earth's hardest mineral

Nanami Kaito
Nissin Diamond

Diamond Tooling

A diamond tool is a cutting tool with diamond grains fixed on the functional part of the tool by methods such as brazing. There are numerous kinds of diamond tools available in the market and they are categorized by manufacturing methods and usage. Diamond is made of the hardest mineral on earth with outstanding hardness, strength, and chemical stability (at temperatures of 600 K or less) and a friction coefficient of 0.1 or less. These properties result in extremely high accuracy compared to cutting tools made from other materials. Moreover, diamond tools can be repolished with sharpened

cutting edges, making them an environmentally friendly tool option.

Diamond tools are ideal for the processing of non-metallic materials and non-ferrous metals due to their excellent hardness and diffusion of heat properties. Diamond tools are commonly used in industries including IT, home appliance, construction machinery, automotive, aerospace, medical equipment and more. In recent years, diamond tools are especially in demand for the processing of optical components and metal molds that are small, require ultra-precision and mirror surface finish.



Diamond Tooling by Nissin Diamond

Nissin Diamond Co., Ltd. is a cutting tool manufacturer based in Takashima, Shiga, Japan. Nissin Diamond has been active in the development, production and sales of diamond cutting tools since the company's founding in 1968. In September 2006, Nissin Diamond became a consolidated company of OSG Corporation.

Nissin Diamond specializes in the production and sales of natural diamond cutting tools, synthetic single-crystal diamond cutting tools, polycrystalline diamond (PCD) cutting tools, and polycrystalline cubic boron nitride (PCBN) cutting tools.

1. Nissin Diamond Co., Ltd. is a cutting tool manufacturer based in Takashima, Shiga, Japan. Nissin Diamond has been active in the development, production and sales of diamond cutting tools since the company's founding in 1968.

2. Nissin Diamond's operators prepare for the machining of new products. Nissin Diamond specializes in the production and sales of natural diamond cutting tools, synthetic single-crystal diamond cutting tools, polycrystalline diamond (PCD) cutting tools, and polycrystalline cubic boron nitride (PCBN) cutting tools. Nissin Diamond's products are used in a wide variety of industries including IT, home appliance, construction machinery, automotive, aerospace, medical equipment and more.

3. Nobuaki Kamiya, CEO of Nissin Diamond, poses for a photograph at the company office in Takashima, Shiga, Japan.

Natural Diamond Cutting Tools

Natural diamonds are formed in the earth's mantle when carbon crystallizes over the course of billions of years at extremely high pressure and temperatures. Natural diamond provides the best sharpness for cutting blades. As a natural product, the quality of these diamonds can vary considerably. However, the unparalleled sharpness they provide as cutting blades is indispensable in the ultra-precision machining of items such as molds for aspherical lenses.

Natural diamond cutting tools are primarily used for finishing in aluminum applications. The diamond can be brazed to an existing indexable insert or a carbide tool body. Natural diamond cutting tools leverage the characteristics of diamond to improve the accuracy of work pieces used in micro and ultra-precision machining.



Synthetic Single-crystal Diamond Cutting Tools

Synthetic diamond is manufactured by crystallizing carbon-based components under strict quality control at high temperature and high pressure conditions. Since this substance is created by the work of humans, supply is more stable than natural diamond. In addition, although synthetic diamond has the same chemical structure as natural diamond, it is a stable crystal with few impurities, defects, and distortion, enabling consistent cutting performance.

Natural and synthetic single crystal diamond cutting tools are manufactured by special brazing and polishing techniques. They are effective for machining that requires stable quality and tool life, such as highly transparent resin machining, optical parts, and precision machining of automobile-related parts.



Surface Roughness Comparison in Aluminum Alloy



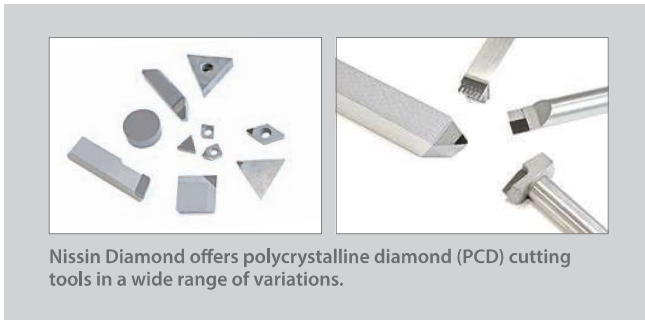
The image on the left is a workpiece machined by a PCD tool with a surface roughness of Ra 300 n. The image on the right is a workpiece machined by Nissin Diamond's synthetic single crystal diamond cutting tool with a surface roughness of Ra 50 n. The workpiece by the single-crystal diamond cutting tool exhibits a shiny surface finish, whereas the surface by the PCD tool measures six times higher roughness. Nissin Diamond's synthetic single crystal diamond cutting tools are effective for machining that requires stable quality and long tool life, such as highly transparent resin machining, optical parts, and precision machining of automobile-related parts.



Nissin Diamond synthetic single-crystal diamond inserts in various shapes and sizes.

Polycrystalline Diamond (PCD) Cutting Tools

Similar to synthetic single-crystal diamond, polycrystalline diamond (PCD) is another type of diamond. PCD cutting tools are most commonly used in non-ferrous and non-metallic materials. As performance in automotive component improves, better aluminum alloys and improved tool performance are also required. PCD tools provide consistent precision and longer tool life than that of carbide tools. In addition to having excellent durability, PCD cutting tools improve the quality of parts and significantly reduce costs across the entire production cycle with faster cutting speed.



Polycrystalline Cubic Boron Nitride (PCBN) Cutting Tools

Polycrystalline cubic boron nitride (PCBN) is an artificial mineral consisting of nitrogen and boron that does not exist in nature. CBN powder is made by treating hexagonal boron nitride (HBN) at high temperature and pressure. The PCBN sintered body is baked at high temperature and high pressure together with binders such as cobalt and TiN. PCBN cutting tools are suitable for machining iron-based metal materials such as hardened steel, cast iron, and sintered metal, which are difficult to machine with diamond tools. PCBN tools also offer higher speed, precision and tool life than carbide tools.

PCBN does not oxidize in the atmosphere up to 1300-celcius whereas diamond begins to graphitize at 700-celcius. Due to this characteristic, PCBN does not react with iron. PCBN is second only to diamond in terms of hardness and thermal conductivity, making it a great fit for machining alloy steel and cast iron of 45 HRC and above.

Diamond and PCBN tools can provide exceptional performance, precision and long tool life in many work applications. Nissin Diamond will strive to further enhance its ability in terms of cost, delivery time, quality, and actively promote the development of new proprietary technologies to respond to evolving market needs.

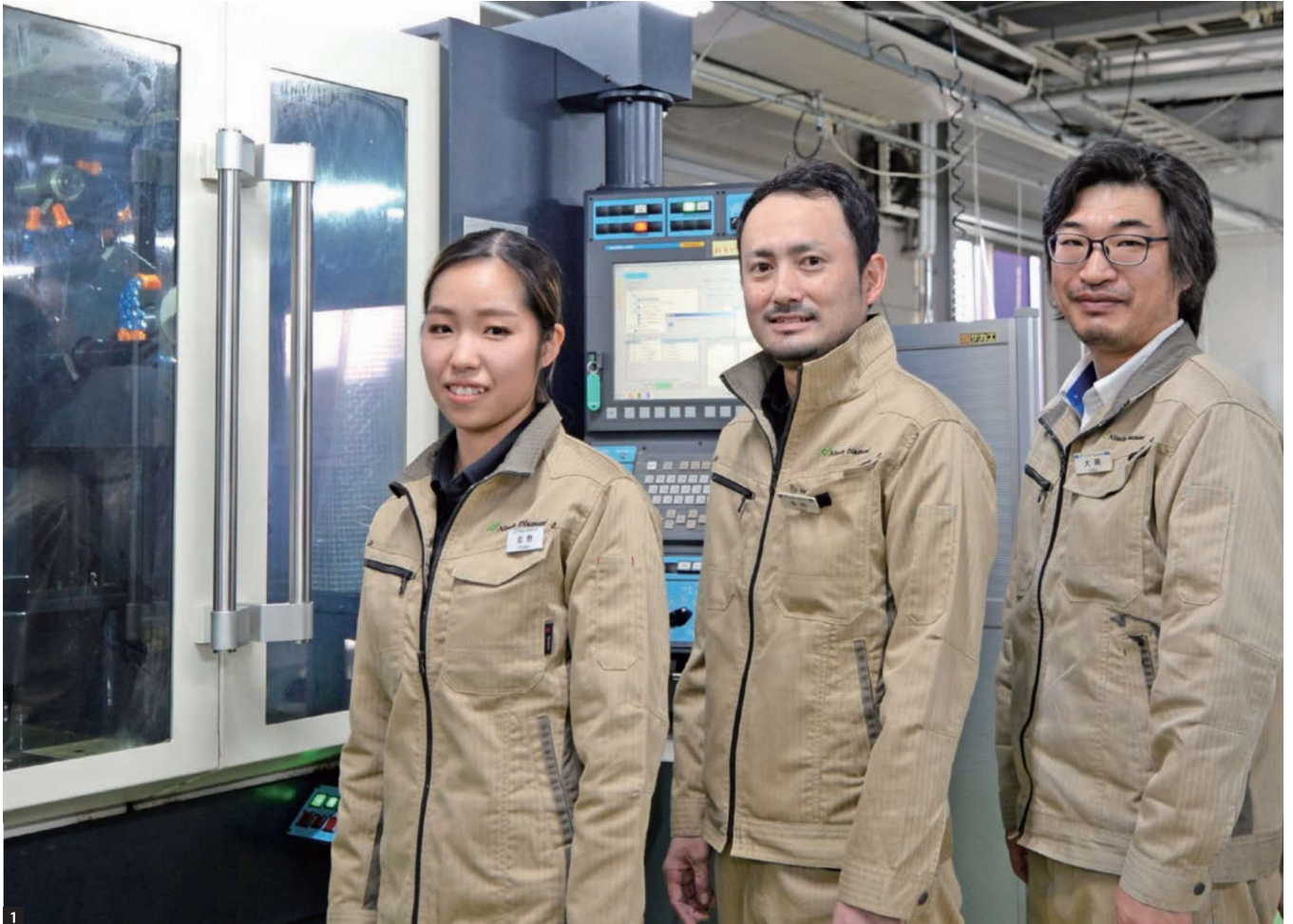




Nissin Diamond's factory in Takashima, Shiga, Japan.

About Nissin Diamond

Nissin Diamond Co., Ltd. is a cutting tool manufacturer based in Takashima, Shiga Prefecture, Japan. Nissin Diamond has been active in the development, production and sales of diamond cutting tools since the company's founding in 1968. Nissin Diamond specializes in the production and sales of natural diamond cutting tools, synthetic single-crystal diamond cutting tools, polycrystalline diamond (PCD) cutting tools, and polycrystalline cubic boron nitride (PCBN) cutting tools. Nissin Diamond's products are used in a wide variety of industries including IT, home appliance, construction machinery, automotive, aerospace, medical equipment and more. Many items used in daily life are machined using Nissin Diamond tools. In September 2006, Nissin Diamond became a consolidated company of OSG Corporation. Currently employing approximately 45 employees, Nissin Diamond's headquarters and its Aiba Factory are located in Takashima in the northwestern part of Lake Biwa, Japan's largest freshwater lake.



Official Brand Mascot Daiyan

Daiyan is Nissin Diamond's official brand mascot. It is a fictional cutting tool character based on the imagery of a diamond cutting tool, which is a core product of Nissin Diamond since its founding in 1968.



The friendly diamond cutting tool character Daiyan serves as Nissin Diamond's brand ambassador in the promotion of the company, the manufacturing industry, and local communities.

The OSG Group

OSG Corporation has individual production facilities for designated tooling lines including taps, HSS drills and end mills, carbide drills and end mills, rolling dies and gauges, tool coating, and machine tools.

In addition to OSG's own product lineup, OSG also fulfills customer needs with its domestic group companies specialized in their respective fields. Each domestic group company manufactures and sells the products they specialize in. Together, they offer a broad lineup of products and services, including the manufacturing of carbide materials and cutting tools, coating and regrinding services, as well as sales of machinery. They also offer various custom services, ensuring that each and every client will always receive products that suit their desired processing environment.

Internationally, OSG has a global network of over 65 business offices in 33 countries, which provides its production sites with accurate feedback about user needs so that the company can quickly design, develop, manufacture and deliver products that precisely meets those needs.



1. Nissin Diamond's operators pose for a photograph at its factory. Currently employing approximately 45 employees, Nissin Diamond's headquarters and its Aiba Factory are located in Takashima in the northwestern part of Lake Biwa, Japan's largest freshwater lake.

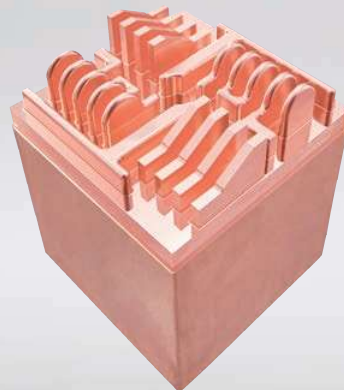
2. Nanami Kaito, Nissin Diamond Customer Service Representative, poses for a photograph at the company factory in Takashima, Shiga, Japan.

AE-LNBD-N DLC Coated Carbide End Mill

High precision and excellent surface finish in copper electrode applications

Hayato Tsuneoka
OSG Corporation Applications Engineer
(End Mill Development Division)

The AE-LNBD-N DLC coated long neck ball end mill is the latest addition to OSG's non-ferrous material processing end mill series. The AE-LNBD-N is designed for the milling of copper electrodes or copper tungsten electrodes used in die-sinking electrical discharge machining (EDM). Its specifications are uniquely engineered to enable the milling of beautiful copper electrodes without burrs, which is an indispensable element for today's die and mold manufacturing that emphasizes on "high precision" and "high quality."





The development and globalization of manufacturing technology has progressed at a rapid pace in recent years, and the same can be said for the die and mold industry. According to the International Special Tooling & Machining Association (ISTMA), the world's die and mold production value increased by about 30 percent from 2008 to 2016. With the passage of time, Japan, which used to hold the world's largest die and mold production value, has fallen in production value since the Lehman financial crisis in 2009, and has since given up the world's number one position to China. On the other hand, in China, supported by a remarkable economic development and an increase in the number of automobiles produced, the production value in 2016 was estimated to be 25 billion dollars, which has almost doubled since 2008.

Copper electrode or copper tungsten electrode, which is the main target material of the AE-LNBD-N, is commonly used for the manufacturing of plastic molds. Today, most of the production of plastic dies has moved from Japan to China and other Asian countries. Even so, however, plastic dies still make up about 30 percent of the die production value in Japan, ranking second after press dies. Most of the plastic molds that require high precision are made in Japan, which offers excellent technical capabilities and quality assurance. The design of the final plastic product is becoming more complicated and smaller in recent times. As the molds are becoming "higher precision" and "higher quality," a demand for the copper electrodes used for die-sinking EDM to become "higher precision" and "higher quality" has also increased.

“High precision” and “high quality” in copper electrodes mean high shape accuracy, little dimensional changes even after long hours of processing, excellent machined surface roughness, and being burr-free. To meet the needs of today’s electrode machining, OSG’s AE-LNBD-N is engineered with a “sharp cutting edge” that realizes excellent work surface quality, a “high ball radius accuracy” that enables high precision electrode machining, and “high durability” capability that suppresses tool wear, generation of burrs and changes in dimension even after long hours of processing.

Sharp Cutting Edge

As shown in figure 1, the quality of the primary relief surface is improved compared to the competitor product. The ridgeline of the cutting edge is sharpened, and this sharpness enables the realization of excellent work surface quality.

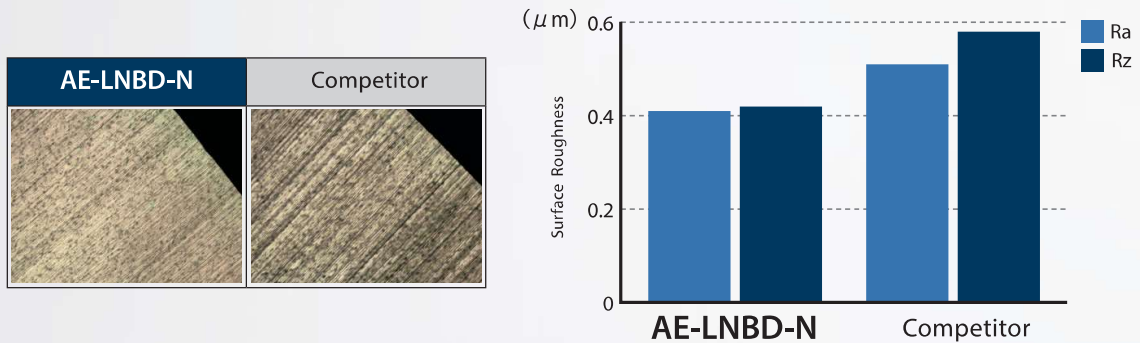


Figure 1. Surface roughness comparison between the AE-LNBD-N and a competitor product.

High Ball Radius Accuracy

As depicted in figure 2, the AE-LNBD-N is engineered with a higher ball R accuracy than conventional products, which enables the processing of highly accurate electrodes.

RE	0.05	0.075	0.1	0.15	0.2	0.25	0.3	0.4	0.5	0.75	1	1.5	2	3	
AE-LNBD-N	+/- 0.002 mm					+/- 0.003 mm						+/- 0.004 mm			
Conventional	+/- 0.005 mm														

Figure 2. Comparison of tolerance of the radius between the AE-LNBD-N and conventional products.

High Durability

The AE-LNBD-N is coated with OSG's DLC-IGUSS, which has high hardness and excellent wear resistance. As illustrated in figures 3 and 4, the DLC-IGUSS coating exhibits overwhelming wear resistance performance compared to CrN coating and Cr-based coating, which are often used for processing steel materials.

In addition, by minimizing the progress of wear during long-hour machining, maintaining a “sharp cutting edge” and “high ball radius accuracy,” it is possible to suppress the occurrence of burrs and dimensional changes for a long period of time compared to conventional products as depicted in figures 5 and 6.

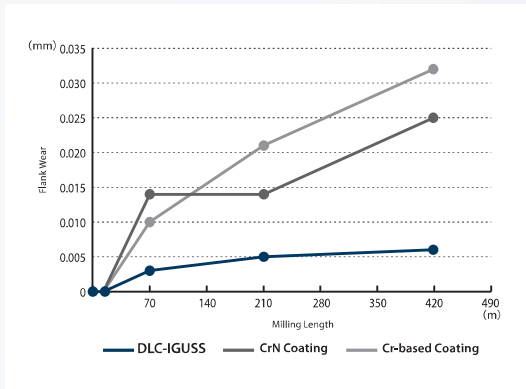


Figure 3. Comparison of milling length and flank wear.



Figure 4. Wear condition of ball flank after milling 420 m.



Figure 5. The AE-LNBD-N achieves good edge without burrs.

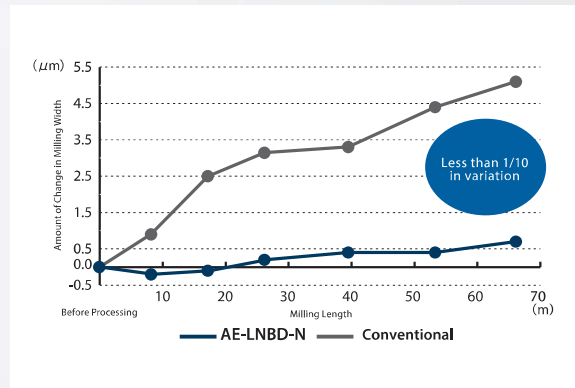


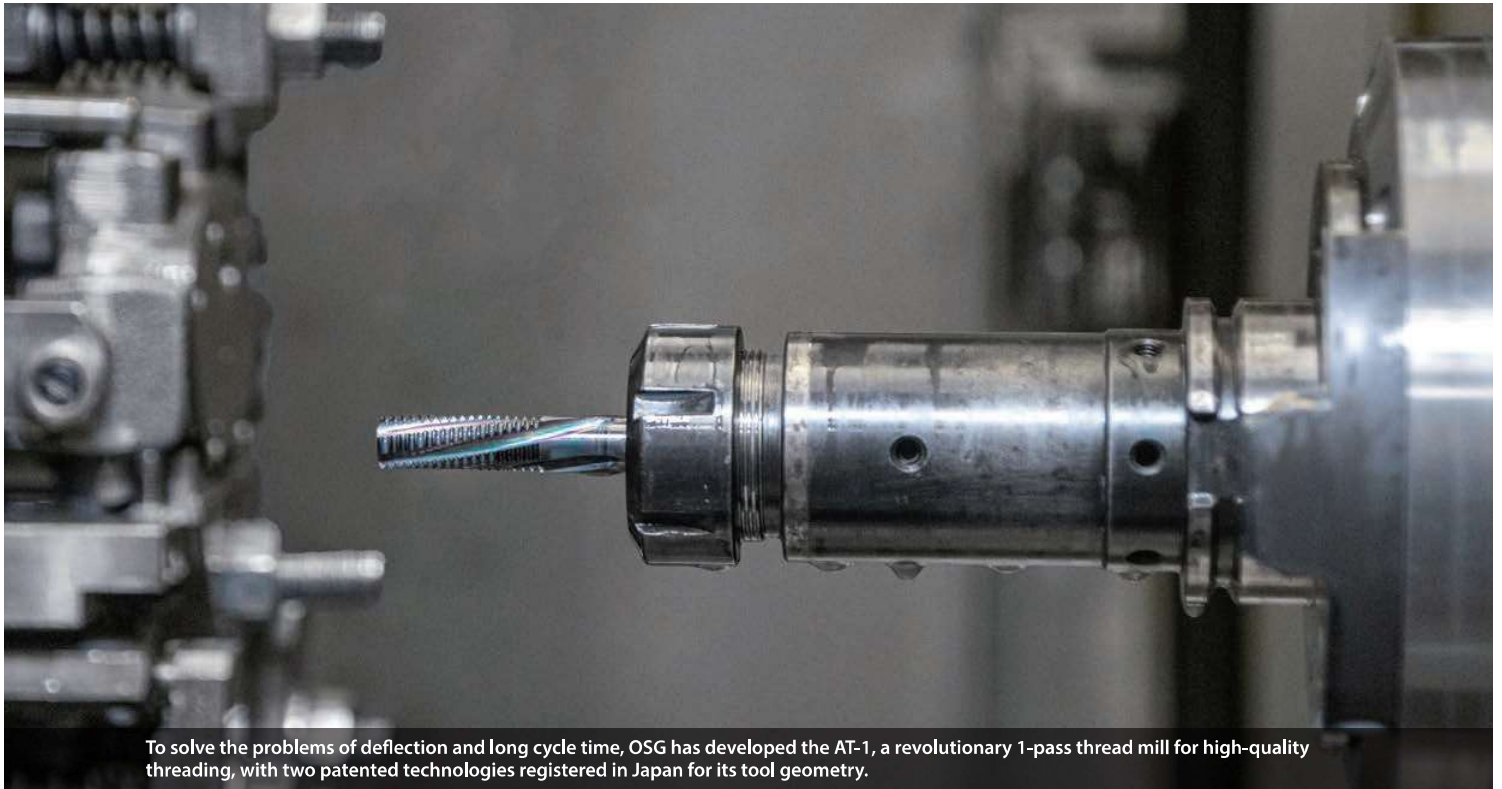
Figure 6. Comparison of dimensional change after milling more than 60 m. The AE-LNBD-N demonstrates stable machining accuracy with little dimensional change, with less than 1/10 in variation versus the conventional product.

The demand for “high precision” and “high quality” in the die and mold industry is increasing year by year, and it is expected that this trend will continue to progress in the future. With excellent accuracy and durability, the AE-LNBD-N will become a new standard in copper electrode processing.



Scan for details





To solve the problems of deflection and long cycle time, OSG has developed the AT-1, a revolutionary 1-pass thread mill for high-quality threading, with two patented technologies registered in Japan for its tool geometry.

One Pass Threading

AT-1 thread mill creates high quality threads in one pass without chatter and deflection in hydraulic component production

Andrea Severi
OSG Italia

Time savings in the machining of hydraulic components can significantly reduce overall production cost even in small batches. Eliminating double passes, chatters, harmonics, and taper of threads were the objectives of Walvoil S.p.A. in its production of hydraulic components.

Founded in 1973 and headquartered in Reggio Emilia, Italy, Walvoil is a global manufacturer of integrated products, electronics, and complete mechatronics systems. Since 2015, Walvoil has become a part of the Interpump Group. In 2016, Walvoil added two brands to its group, Hydrocontrol and Galtech, which were founded in 1969 and 1953 respectively. The Walvoil group has eight facilities within Italy, seven of which are equipped with manufacturing capabilities. The company

also has eight foreign branches and a total of 2,300 employees globally.

Walvoil's core products include hydraulic components such as distributors and hydraulic servo controls, pumps and motors, compact hydraulics, electronic components and PHC systems. Walvoil's headquarters, commercial and production site in Via Adige, Reggio Emilia is equipped with 32 numerical control machining centers, enabling the company to efficiently optimize work cycles in various batch sizes and materials, such as aluminum, steel and gray cast iron, vermicular cast iron and nodular ductile iron.



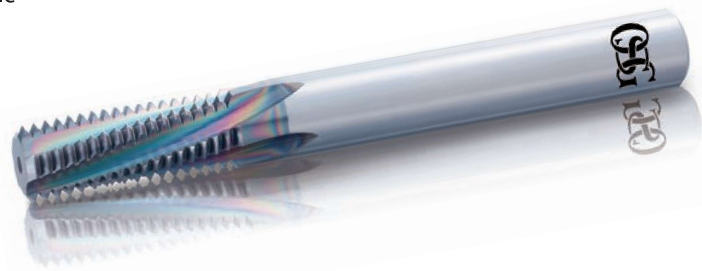
1. Walvoil's headquarters, commercial and production site in Via Adige, Reggio Emilia, Italy.
2. Walvoil uses a MCM MP10 horizontal machining center for the production of hydraulic distributors.
3. From left, Walvoil NC programmer Egidio Lemmi, OSG Italia Sales Engineering and Marketing Manager Andrea Severi and Walvoil Tooling Manager Davide Cabassi pose for a photograph with the AT-1 thread mill at Walvoil's manufacturing facility in Via Adige, Reggio Emilia, Italy.

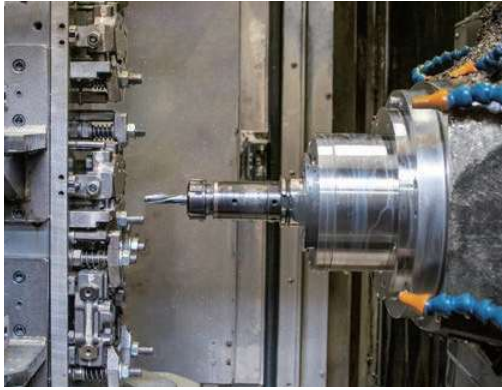
Walvoil was experiencing problems of chatter, tapered threads, bad surface finish and poor tool life in the production of DLS8 hydraulic distributors made of EN-GJL-300 cast iron using a competitor thread mill that is 14 mm in diameter, Z4 and with internal coolant. The part has two G3/4-14 gas threads at an ap of 18 mm. Walvoil has been manufacturing the DLS8 hydraulic distributors since 1996. Batches of several thousand pieces are made annually.

In hopes to optimize cycle time, increase tool life and improve the quality of threads, Walvoil's Tooling Manager Davide Cabassi reached out to OSG Italia for support. Upon a detail evaluation of the application, OSG recommended a diameter 15.67 mm AT-1 thread mill (EDP# 8331087).

To solve the problems of deflection and long cycle time, OSG has developed the AT-1, a revolutionary 1-pass thread mill for high-quality threading, with two patented technologies registered in Japan for its tool geometry. The first patented technology is the AT-1's left-hand helix geometry. Conventional right-hand helix thread mill is most

vulnerable to deflection as the cutting process begins from the tip. In contrast, the AT-1's right-hand cut and left-hand helix geometry begins the cutting process from the shank side, thereby minimizes deflection. The second patented technology is the unequal spacing and variable lead flute geometry, which is commonly applied in end mills. The unequal spacing and variable lead flute geometry minimizes chatter. Even though the amount of cut has increased with one pass cutting, superior and consistent surface finish can be achieved. Applying the unequal spacing and variable lead flute geometry in thread mills involves a high degree of difficulty because the thread pitch has to be adjusted accordingly to the flute geometry, which requires special manufacturing techniques.





OSG's AT-1 thread mill was tested at Walvoil's Via Adige facility using a MCM MP10 horizontal machining center. The tool was mounted on a 140 mm long HSK-63 tool holder with an ER-32 collet.

The AT-1 was tested at Walvoil's Via Adige facility using a MCM MP10 horizontal machining center. The tool was mounted on a 140 mm long HSK-63 tool holder with an ER-32 collet. The total presetting was 192 mm. In terms of cutting condition, the competitor thread mill was used at a cutting speed of $1,000 \text{ min}^{-1}$ and a feed rate of 150 mm/min, completing a thread in two passes. The AT-1, in comparison, was used at a cutting speed of $2,200 \text{ min}^{-1}$ and a feed rate of 250 mm/min, completing a thread in a single pass. The AT-1 was able to complete 2,645 pieces versus the competitor's 470 pieces, achieving more than five times the tool life.

With capabilities to complete threading in a single pass and at higher speeds and feeds, the AT-1 is able to generate an annual cost savings of 62 percent for Walvoil. The problems of chatter and deflection have been completely eliminated. Moreover, the quality of thread is optimal and complies with the UNI-ISO 228/1 standard.

With great satisfaction, Walvoil has extended the AT-1 thread mill to other similar applications with 1/2 gas threads. The AT-1's unique features made it possible to machine under unstable conditions with increased reliability, surface finish and accuracy. With the AT-1's capability to generate threads in one pass at high cutting parameters, it is an optimal thread milling solution that can generate significant cost savings for manufacturers.





1. Inside Walvoil's factory in Via Adige, Reggio Emilia, Italy. The Walvoil group has eight facilities within Italy, seven of which are equipped with manufacturing capabilities. The company also has eight foreign branches and a total of 2,300 employees globally.

2. Pieces of hydraulic distributors being unloaded on a roller conveyor on the MCM MP10 horizontal machining center.

3. A hydraulic distributor mounted on the locking equipment.

4. A hydraulic distributor made of EN-GJL-300 cast iron.



From left, Allied Tool & Die CNC Process and Machining Manager Jamie Lerma, CNC Machinist David Dao and CNC Programmer John Hernandez.

High-efficiency Milling in Inconel 718

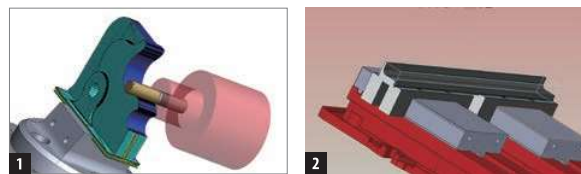
VGM end mill boosts productivity and lowers cost per part in aerospace bracket application

Sean McIntosh
OSG USA

Founded in 1951 in Phoenix, Arizona, United States, Allied Tool & Die Co. is a family-owned precision machine and fabrication company that specializes in the manufacturing of quality parts for aerospace, medical, communications and commercial industries throughout the world. Seventy years since its establishment, this privately owned shop has grown with multiple facilities and an estimated 32,000 square feet of manufacturing space in Phoenix, Arizona.

One of the challenges Allied Tool & Die faced recently was the machining of aerospace brackets made of Inconel 718. As is with most shops, machining Inconel 718 is time consuming. Moreover, due to the material's special high strength and heat resistance properties, short tool life is a common obstacle.

In search for performance improvement, Allied Tool & Die CNC Process and Machining Manager Jamie Lerma reached out to his local OSG representative for new solutions. Lerma had worked with OSG previously on a 13-8 stainless steel application by utilizing OSG's HY-PRO® CARB VGM series end mill to achieve high-efficiency milling.



1. CAD / CAM model of a part made from 13-8 stainless steel. Image courtesy of Allied Tool & Die.

2. CAD / CAM model of an aerospace bracket made from Inconel 718. Image courtesy of Allied Tool & Die.



OSG's HY-PRO® CARB VGM is a high performance variable geometry end mill series. The VGM offering features 5-, 6- and 7-flute lineups, and is available with multiple lengths of cut, with both square end and corner radius variations. This series is suitable for carbon steels, alloy steels, die steels, stainless steels, cast iron, nickel alloy, titanium, and hardened steels up to 45 HRC.

OSG's HY-PRO® CARB VGM is a high performance variable geometry end mill series. Its variable index and unique flute geometry enable the reduction of vibration and chatter, promoting smooth and stable cutting with low cutting forces. With the addition of OSG proprietary multi-layer EXO coating, higher wear and heat resistance is achieved to prolong tool life. OSG's VGM offering features 5-, 6- and 7-flute lineups, and is available with multiple lengths of cut, with both square end and corner radius variations. This series is suitable for carbon steels, alloy steels, die steels, stainless steels, cast iron, nickel alloy, titanium, and hardened steels up to 45 HRC.

For the 13-8 stainless steel application, the VGM end mill dominated the machining result by extending tool life from seven parts to 21 parts per tool. The parts were also completed in half the time and the tool cost is also cheaper than the competitor tool. Lerma was so impressed by the VGM end mill that he decided to apply the tool to the Inconel 718 aerospace bracket application.

Allied Tool & Die was previously using a high feed indexable milling cutter for the Inconel 718 aerospace bracket application. However, the amount of time and money spent on changing the inserts was less than desired. The previous competitor tool was used at 150 SFM (45.7 m/min), 0.009 IPT (0.23 mm/t), 0.05 Aa (ap = 1.27 mm) and 0.75 Ar (ae = 19.05 mm). After reprogramming to utilize OSG's 0.5-inch diameter 5-flute VGM carbide end mill with a 0.030-inch (0.762 mm) corner radius and 1.25-inch (31.75 mm) length of cut (EDP# VGM5-0143), the cutting parameters were changed to 250 SFT (76.2 mm/min, 2,548 min⁻¹), 0.0022 IPT (0.056 mm/t, 713 mm/min), 0.75 Aa and 0.035 Ar. The application went from a 4-hour cycle time to just one hour and 45 minutes. Allied Tool & Die no longer had to keep stopping the machine to rotate or change inserts, which they were doing four times per part previously. By switching to the VGM end mill, the tool was loaded, and the job did not have to be tended until the part was completed. In terms of efficiency improvement, Allied Tool

& Die estimated that the tool change has generated a cost savings of \$6,875 USD on the Inconel 718 aerospace bracket parts. Moreover, with a lower tooling price versus the previous milling cutter, the cost of tooling also decreased by almost \$100 USD per part. With the VGM end mill, Allied Tool & Die was able to machine Inconel 718 at an astounding 250 surface feet per minute (76.2 m/min) – a speed that is only commonly seen in alloy or stainless steels, not HRSA materials.

With the recent successes, Allied Tool & Die's CNC Programmer John Hernandez decided to apply the VGM end mill into most jobs he programs. Being such a versatile tool, the VGM can be used to machine anything from common carbon steels up to the nickel alloys required by the aerospace industry.

"This VGM end mill saved us a ton of time," said Allied Tool & Die CNC Process and Machining Manager Jamie Lerma, who has started ordering the VGM series end mill to keep in inventory for whatever job comes up.



3. A part made from 13-8 stainless steel that was machined by OSG's HY-PRO® CARB VGM end mill.

4. An aerospace bracket made from Inconel 718 that was machined by OSG's HY-PRO® CARB VGM end mill.

Adding Values

AE-VML anti-vibration long carbide end mill demonstrates stable tool life and reduces tooling cost in secondary process after metal additive manufacturing of Inconel aerospace workpiece

Magnus Hoyer
OSG GmbH

Inconel is a high-strength, corrosion-resistant nickel alloy that is commonly used in aerospace applications. Milling complex parts made of Inconel is a difficult and costly machining process due to the material's high tensile strength, which can wear off cutting tools quickly, resulting in high wear rates, chipping and breakage. In addition to shortened cutting tool life, material loss is also a prominent problem where parts would warp due to effects caused by residual stresses and self-hardening during machining. In recent years, metal additive layer manufacturing has become a new alternative to the traditional manufacturing method of machining Inconel parts. Rather than removing materials, additive manufacturing builds a component layer-by-layer, which allows greater design freedom in terms of part complexity. Moreover, additive manufacturing eliminates material waste of expensive superalloys through nondestructive construction, improving overall efficiency and cost savings. However, new manufacturing method also comes new challenges. The secondary process after metal additive manufacturing has very many similarities to the milling of built-up welding parts, which can be tough on the cutting tools and is time-consuming.

PARARE GmbH, a part manufacturer specialized in additive metals and plastic processing, was recently seeking to improve the milling process after metal additive manufacturing of highly complex Inconel workpieces for the aerospace industry. Established since 2017, the Baden-Württemberg, Germany based company is an expert in the use of additive technologies. PARARE manufactures highly innovative components for a wide variety of industries made of materials such as aluminum alloys, stainless steels, titanium, Inconel, tool steel and plastics.

The additive manufactured bionic structures in question are made of Inconel 625 and Inconel 718 and aluminum. The batch size typically ranges from a single piece to approximately 50 pieces. The parts are milled by a Hermle 5-axis machining center with HSK-A63 spindle.



The AE-VML long type end mill is a part of the AE-VM anti-vibration carbide end mill series designed to attain an all new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications.



1. Additive manufactured clamping arm built for transporting engine parts in the automotive industry. These additive parts offer significant advantages versus conventional manufacturing methods with much improved strength-to-weight ratio.

2. An aerospace part made by PARARE. PARARE manufactures highly innovative components for a wide variety of industries made of materials such as aluminum alloys, stainless steels, titanium, Inconel, tool steel and plastics.



From left, OSG Germany Technical Sales Representative Bruno Göpfrich, PARARE Head of Production Michael Meyer and PARARE Managing Director Sven Skerbis pose for a photograph at PARARE's manufacturing facility in Frickenhausen, Baden-Württemberg, Germany.

PARARE was originally using a competitor solid carbide end mill for the application. However, performance was unstable, and the unit price was very high. PARARE initially did not know about OSG's cutting tools. However, when Michael Meyer joined PARARE as the head of production in September 2020, Meyer decided to test a few of the OSG cutters since he had positive experiences in the past with the company. After a detail evaluation of the application, OSG Technical Sales Representative Bruno Göpfrich brought in OSG's AE-VML (dia. 16 x 64) for the cutting trial.

The AE-VML long type end mill is a part of OSG's AE-VM anti-vibration carbide end mill series designed to attain an all-new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications. The AE-VM's sharp positive rake angle geometry significantly reduces cutting force to minimize tool wear and potential damage to the workpiece even under aggressive cutting conditions. Cutting vibration is minimized with the AE-VM's unequal spacing of teeth and variable-lead geometry. Furthermore, its unique flute form helps facilitate trouble-free chip evacuation to enable stable

and consistent performance. With the addition of OSG's original DUARISE coating, tool life can be enhanced by its excellent lubricity, superior friction-resistance and high oxidation temperature qualities. Available in a wide variety of styles and specifications, the AE-VM series is designed to accommodate a wide range of milling operations in stainless steel, cast iron, carbon steel, alloy steel and hardened steel.

The cutting trial was a major success. Due to confidentiality reasons, the cutting conditions cannot be disclosed. However, OSG's AE-VML is able to achieve more than twice the tool life and reduce tooling costs by five times versus the previous competitor tool.



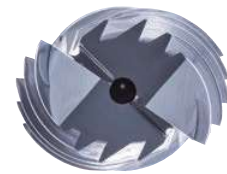
AT-2 R-SPEC

Thread Mill for Non-ferrous Metals

Nicknamed "ThreadRacer," the AT-2 R-SPEC thread mill is designed to dramatically reduce machining time in non-ferrous metal applications such as aluminum alloy by its continuous helical cutting ability, which combines drilling and threading into a single process. The AT-2 R-SPEC is also effective as a countermeasure against cutting position misalignment in cast holes.

The AT-2 R-SPEC features a left-hand cut configuration for climb milling to prolong tool life. Higher efficiency by load

distribution is achieved by its roughing teeth geometry. Moreover, the AT-2 R-SPEC's 2-flute wide chip room configuration and oil hole allow for superior chip evacuation (applies to dia. 4.6 mm or more). With the addition of OSG's DLC-IGUSS coating, long tool life can be achieved in non-ferrous metals such as aluminum alloys that require welding resistance and lubricity.



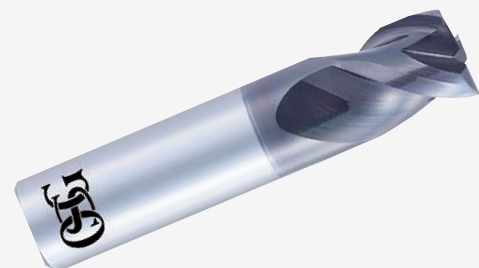
AE-VTSS

Anti-vibration Carbide End Mill Compatible with Sliding Head Lathes

The AE-VTSS is optimally designed to accommodate sliding head lathes, featuring an overall length of 50 mm or less and a length of cut of 1.5 x D or less. The AE-VTSS' 3-flute specification and bottom cutting edge hook shape contribute to the creation of stable chip shape and improve chip evacuation. Chattering is minimized by the AE-VTSS' unequal spacing of teeth and variable-lead geometry to enable stable and high-efficiency milling. With the addition of OSG's original DUARISE coating, tool life can be enhanced by its excellent lubricity, superior

friction-resistance and high oxidation temperature qualities.

The AE-VTSS is designed to support a wide range of milling operations including plunging in stainless steel, cast iron, carbon steel, alloy steel and hardened steel (up to 40 HRC).



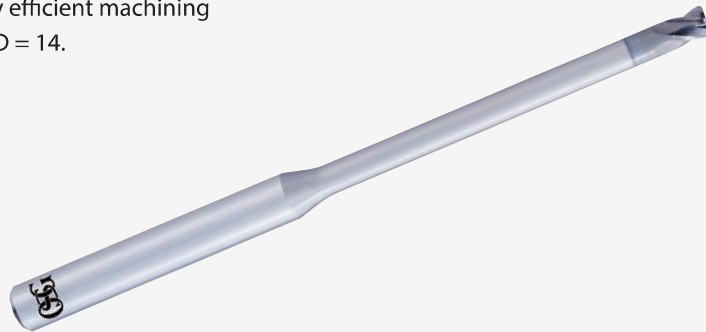


AE-CPR4-H

4-flute Long Neck Corner Radius Carbide End Mill for High-hardness Steels

The AE-CPR4-H 4-flute long neck corner radius carbide end mill is engineered to achieve high-efficiency milling in high-hardness steels. Its new gash specification with a spiral shape forming from the center to the corner radius improves chip evacuation and prevents chips from getting caught. Chattering is minimized by the AE-CPR4-H's unequal spacing teeth geometry, enabling highly efficient machining even in deep milling of $L/D = 14$.

With the addition of OSG's DUREY coating and smooth surface treatment, surface accuracy is further improved. The AE-CPR4-H is available from diameter 0.2 mm up to 4 mm with a total of 176 items.



PXSH

Exchangeable Head End Mill for High-hardness Steels

The PXSH is a multi-flute square type exchangeable head end mill. It is a part of the PXM exchangeable head end mill series designed for large-diameter applications. The PXM series offers significant time savings versus solid tools as only the exchangeable head would require replacement. It also provides greater productivity versus indexable tools as the exchangeable head can be selected based on the number of flutes. The PXSH is available in 6-flute and 8-flute configurations. The PXSH features unequal spacing teeth geometry to minimize chattering. With optimal cutting

edge specifications, high efficiency and stable milling performance can be realized in high-hardness steels. In addition, the PXSH is able to achieve long tool life under aggressive cutting conditions due to the DUREY coating's excellent toughness, high heat resistance and abrasion resistance characteristics.



OSG Participates at INTERMOLD 2022



1. OSG staff gather for a group photograph before the start of INTERMOLD 2022 at the INTEX Osaka in Japan.



2. At INTERMOLD Osaka 2022, OSG exhibited its latest tooling innovations, including the AE-H series for high-hardness steel applications.

INTERMOLD is a leading international trade fair that showcases state-of-the-art moldmaking technology, tooling, design and application development. The 33rd INTERMOLD took place from Wednesday, April 20 to Saturday, April 23, 2022 at the INTEX Osaka in Japan. According to the INTERMOLD Development Association, approximately 23,875 visitors participated at the 4-day event.

At INTERMOLD Osaka 2022, OSG exhibited its latest tooling innovations and hosted a seminar along with its partner Roku-Roku Sangyo on the topic of direct and deep rib milling of high-hardness steel material. Key highlights include the recently released AE-CPR4-H long neck corner radius carbide end mill for high-hardness steel; as well as the AE-VTSS anti-vibration carbide end mill that is compatible with sliding head lathes.

Taiho Tool Opens New Office in Taipei



The Chicony Building in Sanchong District, New Taipei City, Taiwan.

Taiho Tool Mfg. Co., Ltd. (Taiho), OSG Corporation's subsidiary in Taiwan, has opened a new office in Taipei on April 13, 2022. Located on the 18th floor of the Chicony Building in Sanchong District, New Taipei City, Taiho's new 260-square-meter office includes a warehouse to accommodate tooling needs in the nearby region. Situated approximately 15 minutes away from the Taipei Station by car, the 39-story, 181.6-meter skyscraper features conference rooms and a selection of dining options, making it a convenient location for hosting seminars and other company events.



1. View of the surrounding region from the 18th floor.



2. Reception desk at the Taipei office.

About Taiho Tool Mfg. Co., Ltd.

Headquartered in Kaohsiung, Taiwan, Taiho Tool Mfg. Co., Ltd. was established in 1969 and is the second overseas subsidiary of OSG Corporation. Taiho today employs more than 330 staff and has transformed from a traditional SKS tap factory into a major high-quality cutting tool manufacturer with production sites, stock centers and sales offices located throughout Taiwan and mainland China. Taiho's key products include taps, nut taps, rolling dies, drills, end mills and gauges.



3. Taiho's new 260-square-meter office.

4. The warehouse of Taiho's Taipei office.

OSG Hosts Benchmark and Networking Event to Promote Competitiveness in Tool and Die Industry

OSG GmbH hosted a benchmark and networking event with partner Marktspiegel Werkzeugbau, a market research firm, to evaluate the tool and die industry with neutral data at the OSG Academy in Göppingen, Germany on July 7, 2022. More than 60 representatives, primarily decision-makers from the tool and die industry and suppliers, participated at the event to cooperatively benchmark for the first time in this fashion. Marktspiegel Werkzeugbau evaluates German tool and die makers as well as series production manufacturers anonymously according to their competitiveness, thus enabling the assessment of positioning in direct comparison to the industry environment. The focus of the event was not only on insights into data and facts, but also on current market development and trends. "Becoming better with industry knowledge" was the motto that ran through the entire event.



A group photo from the benchmark and networking event with partner Marktspiegel Werkzeugbau, a market research firm.

Innovations for the Tool and Die Industry

OSG maintains absolute control over every aspect of its manufacturing capabilities. OSG products are produced in-house – from the production of tool material, creation of tool geometry, to the development of its own proprietary coatings – the three vital elements in the manufacturing of superior cutting tools. OSG's expertise in the tool and die industry is demonstrated by the AE-H series, the company's latest milling innovation designed for hardened steel applications. The AE-H end mills are available in a wide range of configurations with stable machining capability at large cutting depths and long tool life. OSG's original DUREY coating with SiC structure provides superior heat resistance, wear resistance and high surface quality optimized for hardened steel milling. Through a tour of the production facility, it became clear to visitors in all facets that OSG products are manufactured in exclusive quality. In addition to tooling solutions, OSG also offers comprehensive services such as machining strategies for standard products as well as optimization of machining routines at the client's facility.

OSG Around the World

Employee Interview with **Yoshiyuki Saito**

Tell us about your work and experience at OSG.

I studied business management and marketing in college in Japan and the United States. After graduation, I was recruited by NAS Precision, one of OSG's group companies in Illinois, which later merged into OSG USA. I held multiple roles during my 14-year tenure in America, where I served as sales engineer, sales manager, and vice president at NAS Precision; I was also sales manager at OSG Sterling Die (a group company that specializes in cold forming products and was later merged into OSG USA); and sales manager at OSG USA. In 2015, I was transferred to OSG Corporation in Japan and served as a sales representative at the Nagoya sales office in the central sales division. Two years later, I was appointed as the general manager of sales and customer service at OSG Thai.



Profile

Location: Thailand

Position: General Manager of Sales and Customer Service at OSG Thai

Joined OSG: 2001

Motto: "Nothing will happen until action is taken."

Tell us about your daily routine.

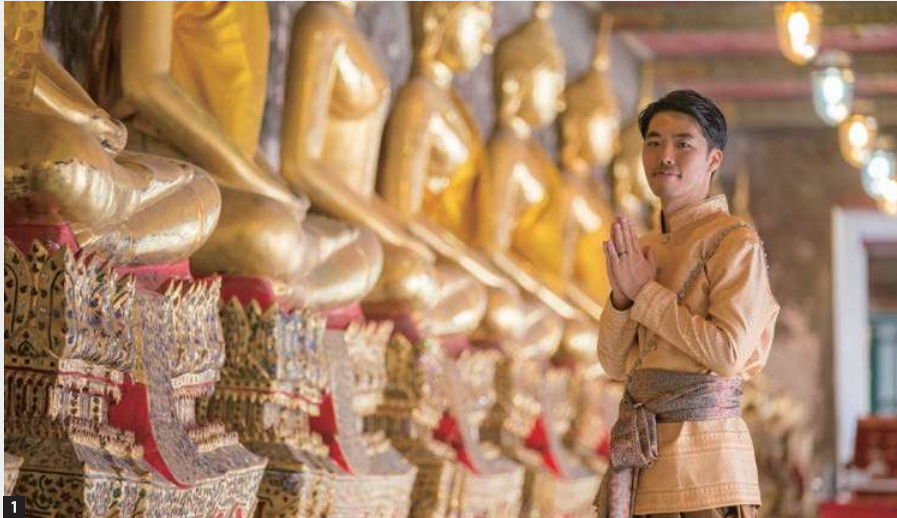
My daily routine involves developing new ideas, systems, and workflow to enhance sales volume. I am also in charge of managing sales and booking, as well as OSG Thai stock items based on sales record in Thailand.

What is most challenging about your work?

Every country is unique. It is always a challenge to fuse with a different culture while attempting to add my own philosophy in the workplace. People in Thailand respect seniors and are great listeners. However, they can also be very conservative. It is crucial to first learn and understand the way of business in Thailand before applying changes even for the purpose of achieving higher goals. A longer period of time is required to implement change in Thailand than what I have experienced in Japan and the United States.



Center, Saito poses with OSG Thai's sales team for a photograph.



1. Saito poses for a photograph at the Wat Suthat Thepwararam Ratchaworahawihan in Bangkok, Thailand.
2. Saito poses for a photograph during sunrise at the Red Lotus Lake in Udon Thani, Thailand.
3. Far right, Saito poses for a group photo with OSG Thai employees and the owner and staff of BT&T, a local distributor in Thailand.
4. Wat Rong Khun, better known as the “White Temple,” is one of the most recognizable temples in Chiang Rai Province, Thailand.
5. The five statues of Buddha at Wat Pha Sorn Kaew located in Phetchabun of north-central Thailand.
6. Right, Saito snorkeling with his wife in Ko Raet, Chonburi, Thailand. On his day off, Saito enjoys snorkeling in the oceans.



OSG Thai special step drills.

What is unique about OSG Thai?

We have everything in Thailand because of our multicultural market. There are many Japanese transplants as well as local Thai companies, Chinese-Thai companies and European companies. Thus, not only do we import and sell OSG Japan products, we also manufacture carbide cutting tools and die products domestically in Thailand, and provide coating services. Our stock center has more than 15,000 items and offers stable delivery service for not only OSG Japan standard items, but also OSG Asia catalog items to fulfill local manufacturing needs.

What is your favorite OSG tool?

OSG Thai’s special drills are my favorite tools. When I worked as a sales engineer in my first job, I used to design custom tools based on the client’s drawing. I find it rewarding to be involved in the product development process, with the finished product made in front of my own eyes.

How do you spend time on your day off?

I enjoy traveling to places I have never been to before. In Thailand, there are many beautiful natural sights and historical buildings. One of the best places I would like to introduce is Chiang Rai in the northmost province of Thailand. It is filled with beautiful mountain sceneries, incredible temples, and great local Thai food. I also enjoy snorkeling in the oceans, and Thailand is a fantastic destination for these outdoor activities.



shaping your dreams

Superior performance in high-hardness steel applications

AE-H

Carbide End Mill Series



scan for details

