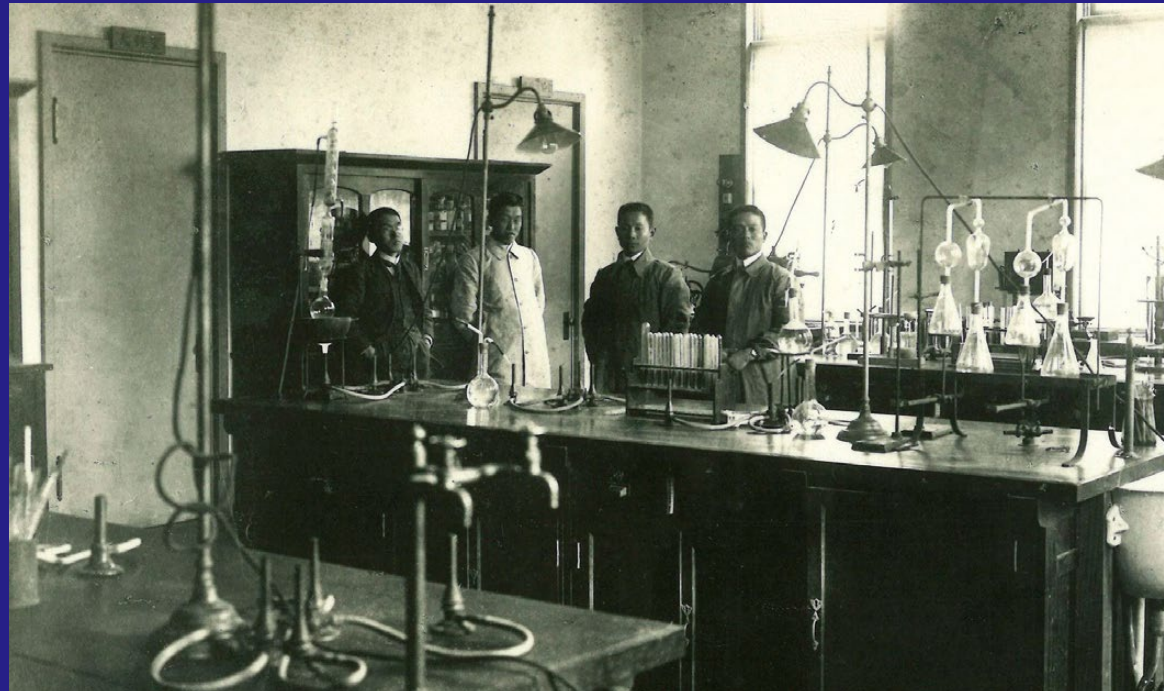


A Picture of Sumitomo Electric in Those Days

1930

Formation of the Research Division



Staff members of the Research Section around 1919

Pursuing R&D in Chemistry, Metals and Electricity Fields

In around the 1920s, Sumitomo Electric Wire & Cable Works began developing a wide variety of new products based on its electric wire and cable manufacturing technology. One of its research efforts culminated in the cemented carbide tools IGETALLOY™, which remains one of our core products. In those days, the Company urgently needed to improve dies as a tool for making copper wire longer and thinner. Knowing that tungsten carbide alloy had been invented in Germany, the company soon launched its research. While incorporating technology from abroad, the company succeeded in development, laying the cornerstone for the subsequent growth of IGETALLOY™.

At the same time, the company also began research on special steel wires. When most of such wires used in Japan were being imported, requiring development and production of excellent domestic products, the company succeeded in trial production of monel metal wire, composed of nickel acetate and copper alloy.

Afterwards, although it had been considered impossible to draw a stainless steel block into wire, the company succeeded in doing this after the first case in Germany. Moreover, regarding capacitors, the company hit upon the idea of applying OF-cable technology. This research came to fruition as a successful production of an OF-type capacitor in 1929, followed by the realization of domestic production.

In 1930, the Research Section of the Engineering Division was spun off as an independent Research Division. Accelerating research and development of technologies related to manufacturing electric wire and cable, such as chemistry, metals and electricity, the company invented new products, some of which have led to our current business operations. In 1939, the company was renamed Sumitomo Electric Industries, Ltd. The new name indicated then as now our strong determination to reinforce efforts to achieve future business expansion and prosperity.

 **SUMITOMO
ELECTRIC**
Connect with Innovation

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Sumitomo Electric Group Magazine

vol. **05** 2018

Innovative Development,
Imagination for the Dream,
Identity & Diversity

Feature

Multidrill Paves the Way for Next-Generation Manufacturing

 Sumitomo Electric Group Magazine
vol. **05**

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**SUMITOMO
ELECTRIC
GROUP**



Productivity improvement and cost reduction have long been on the list of the most important challenges to the manufacturing industry. Rapidly advancing technological innovations, such as information and communication technology (ICT), served as an engine to meet these challenges. Currently, attempts are made to innovate the manufacturing industry with further considerations for high efficiency, labor saving and reduced environmental burdens with the keyword being “Internet of Things (IoT).”^{*} For example, things such as factory facilities and equipment are connected to the Internet for data acquisition and analysis. These efforts are undergoing acceleration to enable productivity improvement. In other words, the goal is to realize a connected or smart factory, by virtue of IoT. This is known as “Industry 4.0” or the Fourth Industrial Revolution.

The Sumitomo Electric Group has contributed to productivity improvement and cost cutting by providing an extensive range of cutting tool products made of cemented carbide, cubic boron nitride (CBN), and sintered diamond to name a few. Among these products, this feature article focuses on the Multidrill. In 1984, Sumitomo Electric launched the Multidrill into the market, a revolutionary product that brought innovation to manufacturing industry on a global scale. The following introduces the untold development stories, the present and future prospects of the Multidrill.

^{*} The concept of connecting a myriad of things to the Internet for information exchange in order to convert things to data and advance automatization based on the data, and thus creating new value.

The Challenges to Innovate Manufacturing Industry

Social demand for next -generation manufacturing

It Started with Iget alloy.TM

Multidrill Development History

Cemented Carbide Revolutionized Cutting Tools and Changed the Manufacturing Industry

Before the development of cemented carbide in Germany, most cutting tools were made of high-speed steel. Cemented carbide enabled cutting tools to evolve into ultra-hard tools.

Cemented carbide is a composite material produced by mixing and sintering hard tungsten carbide and cobalt. The material features high hardness, high wear resistance and high heat resistance. It enables machining at a higher speed than high-speed steel. Cemented carbide innovated the cutting process. The world's first cemented carbide was invented in Germany in 1923. It was launched into the market in 1927. Sumitomo Electric began to study the material in the same year. In 1928, the Company successfully developed a prototype wire-drawing die (a tool used to finish wires to a specified diameter) made of cemented carbide. In 1931, cemented carbide cutting tools were commercialized under the brand "Iget alloy.TM" Since then, Iget alloy.TM has evolved into an extensive range of products to fulfill all kinds of machining needs covering turning, milling, end milling and drilling.

Development of Cemented Carbide Drills Designing Chip Formation

In more than 80 years of the history of cemented carbide, the development and launch of cemented carbide drills was an epoch-making event, which enabled machining in the manufacturing industry to undergo a remarkable evolution. In the area of drilling, it had been believed difficult to use cemented carbide for strength reasons. In 1982, Yoshikatsu Mori daringly met this challenge.

"The development of cemented carbide drills began with their application to castings and other relatively easy-to-drill materials. In the late 1970s, cemented carbide drills that could machine steel began to come into wide use. These drills had a steel shank for tool mounting purposes and spiral flutes with a cemented carbide cutting edge brazed at the tip, and were 12 mm or more in diameter. However, a survey of how high-speed steel drills were used revealed that an overwhelming proportion of them were mostly 10 mm or less in drilling diameter. Therefore, we undertook a development project envisioning the development of small-diameter drills at first, and then applied the results to large-diameter drills," says Mori.

Drills differ from other cutting tools in that they need to additionally have the function of evacuating chips produced during cutting from the bottom of the hole. This was the inhibiting factor in developing a cemented carbide



Early Iget alloyTM Products

drill. One essential requirement for drills in machining is that they do not break. If chips are not evacuated, the drills will break. To clear chips smoothly, the flutes must be wide. If wide flutes are provided, it will result in an accordingly reduced cross-sectional area, and the drill will decrease in strength. In summary, the point was how to enlarge the cross-section of the drill for improved strength and remove chips smoothly through the narrowed flutes. This was the most difficult challenge.

"We took note of the chips. Large chips become stuck in the flutes of the drills. However, short and thinly cut chips are smoothly ejected. Through repeated prototype development and evaluation processes, we discovered that by adopting an arc-shaped cutting edge, it was possible to produce short and thinly cut chips for smooth evacuation. This was the most significant breakthrough in developing cemented carbide drills," recalls Mori.

Market valued the excellent machining efficiency of Multidrill

In 1984, after a two-year development period, production and sale of the Multidrill commenced. The market enthusiastically welcomed the product. The Multidrill was selected successively by a number of customers, including major automakers and demand for it grew rapidly. Compared with the conventional high-speed steel drills, the Multidrill boosted machining efficiency 4- to 10-folds, enabling drastic productivity improvement in machining.

Nonetheless, a drill is a cutting tool that may in some cases fail to demonstrate its true performance depending on the machine with which it is used, the condition settings, and usage. As a solution to this matter,

they promoted educational activities such as visits for users, the development and provision of a training framework and the holding of training seminar. These efforts spurred the widespread use of the Multidrill. More importantly, it was significant to build a service network. During use, the cutting edges of a drill wear and become ineffective in cutting. To use the drill again, the cutting edges need to be re-sharpened to return them to their original condition. Naturally, the quality of the re-sharpened cutting edges must be as good as those of a brand new drill. At the same time, customers demand that they provide the service at low cost and within a short delivery schedule. To meet these challenges, they built a new model of a re-sharpening network by establishing a partnership with grinding service companies across Japan. Additionally, they worked on the development of re-sharpening equipment and provided programs to machine manufacturers.

"The Multidrill was once thought to be miles away from commercialization. Now I recall this time with fondness. It is true that I have striven to bring dreams closer to reality with my colleagues, navigating many twists and turns. I have acquired substantial knowledge. My next challenge is to contribute to the evolution of the Multidrill by transferring my knowledge to many people," says Mori.

Multidrill Paves the Way for Next-Generation Manufacturing



First catalog used when the Multidrill was launched



Sumitomo Electric's current line of cutting tools

Yoshikatsu Mori
Senior Engineer,
Sumitomo Electric Hardmetal Corp.

Evolution of the Multidrill

Multidrill Entering Chapter 2

Multidrill with Through-Tool Coolant Holes for additionally deep drilling with high efficiency

Multidrill with Coolant Holes spouting cutting fluid during drilling

Multidrill Paves the Way for Next-Generation Manufacturing

Collateral Development of Cemented Carbide and Coating

The development of the drill design progressed concurrently with the development of a new cemented carbide substrate and coating. Cemented carbide is very hard and is therefore, at the same time, poor in flexibility and brittle. More specifically, the Multidrill was subjected to chipping on the cutting edges and breakage of the body depending on the operating settings. To overcome these challenges, the ideal composition of tungsten carbide and cobalt has been studied. Moreover, titanium carbide and other additives have been researched to develop cemented carbide for drills and evolve

them to be more resistant to breakage.

The development of coating technology was promoted with the aim of additionally extending the tool life of the Multidrill. In short, this coating is intended to form a thin ceramic film on the surface of the drill for high durability. One key point was the material composition of the thin ceramic film. Cutting tools including drills are constantly required to improve in wear resistance and heat resistance. The coating applied to the first Multidrill was made from titanium carbonitride developed by optimizing the composition of titanium carbide and titanium nitride. In the 1990s, Sumitomo Electric developed ZX Coating, applying the world's first multilayer nanotechnology and improved the performance of its cemented carbide drills drastically. Subsequently, the coatings evolved steadily.

"Coatings are evolving still today through the supplementation of new ingredients such as chromium and silicon to the multilayer nanotechnology that produced ZX Coating. We will continue to work on coating development following specific product conception, concurrently with the deployment of the Multidrill in diverse applications." (Makoto Setoyama)



The bold challenge in collaborating the trinity of design, cemented carbide substrate and coating spurred the evolution of the Multidrill.

Responding to Diversified and Sophisticated User Needs

While the Multidrill evolved steadily in line with the needs of the market and the times, the first breakthrough was the Multidrill with coolant holes created in the 1990s. This Multidrill had holes running through its body to allow cutting fluid (water or oil) to pass through. One important point of the Multidrill was the achievement of smooth evacuation of chips. Holes at the tip of the drill allow cutting fluid to spray out, further improving the chip evacuation capability of the Multidrill and enabling the drilling of deeper holes to a depth of 5 to 10 times the hole diameter with higher machining



efficiency. This evolution helped expand the applications of the Multidrill at a stroke. The next evolutionary milestone was the deep hole drill, which emerged in 2000. As its name suggests, this model of the Multidrill produced very deep holes 20 to 30 times the hole diameter, which had been believed impossible. These evolutions were the results of efforts in responding precisely to the diversified needs of the user.

In the course of these responses, various initiatives were promoted. For example, there was a response to weight reduction accompanying demand for reduction in fuel consumption in a car. One symbolic way of reducing the weight of an automobile was to replace steel with aluminum. In line with this trend, although the Multidrill was developed as a tool for steel machining, they developed another version of the

Multidrill tailored for aluminum drilling to further improve machining efficiency. To meet the demand for part size reduction as a way of reducing the weight, they endeavored to reduce their drill bit diameters to a minimum of 0.03 mm. Furthermore, the Sumitomo Electric Group has responded to diversifying drilling needs precisely and promptly, including the challenge of machining titanium and other hard-to-cut materials used in aircraft parts.

To Tap New Markets Taking Advantage of Sumitomo Electric's Seamless Production System

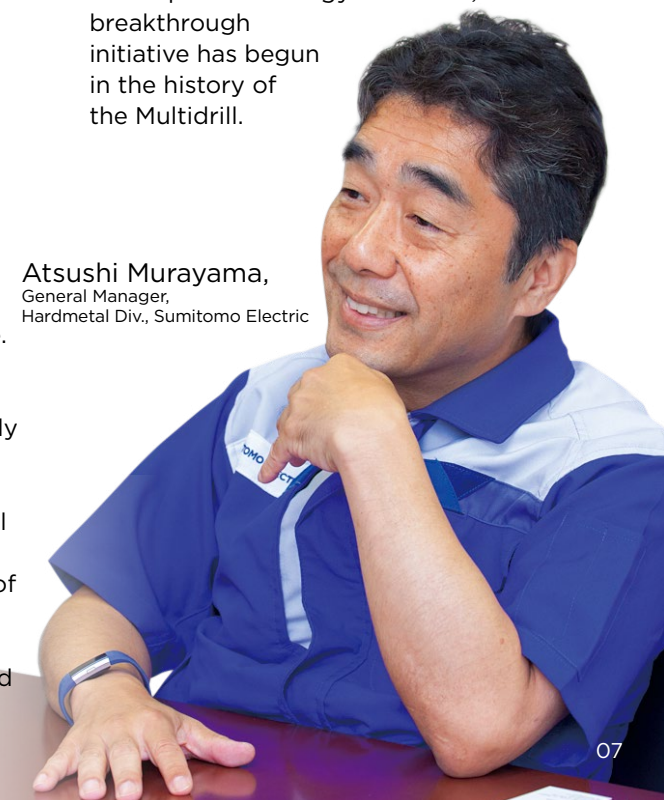
After the expiration of the design patent, competitors followed suit. However, the Multidrill's market supremacy reputation in Japan and abroad has been outstanding to date. This is backed by the fact that Sumitomo Electric is the pioneer in cemented carbide drills and has a fully equipped integrated production system.

"The manufacturing of the Multidrill is completed within the Sumitomo Electric Group, from the production of raw material powders to machining and coating. This is the strongest engine that produces high quality and high performance. We also strive

actively to achieve recycling. One raw material of the Multidrill is tungsten. Tungsten mines are located predominantly in China. Aiming to stabilize the supply of tungsten, we are accelerating our efforts to realize recyclable manufacturing," says Atsushi Murayama.

The seamless manufacturing framework built within the Group has enabled us to take a flexible product development strategy. Moreover, a breakthrough initiative has begun in the history of the Multidrill.

Atsushi Murayama,
General Manager,
Hardmetal Div., Sumitomo Electric



Makoto Setoyama,
Senior Assistant General Manager,
PVD Development Group, Hard Materials Development Dept.,
Sumitomo Electric Hardmetal Corp.



At the development site, there is active exchange of opinions across generations.

Masaaki Jindai
Assistant Manager,
Round Tools Development Group,
Tool Designing Dept.,
Sumitomo Electric Hardmetal Corp.

Koji Takahashi
Round Tools Development Group,
Tool Designing Dept.,
Sumitomo Electric Hardmetal Corp.
"I am in charge of the development of
replaceable head drills. My current
challenge is to create cutting edges with
high durability. The present goal is to
launch the drill that I am involved in into
the market."

Ryo Hikawa
Design & Engineering Section,
Engineering Div.,
Tokai Sumiden Precision Co., Ltd.
"I am working as a troubleshooter to solve
problems at our users. I would like to help
our customers improve their machining
efficiency by proposing optimal
machining ideas according to their
working environments and needs."

Yuki Tsutsumi
Round Tools Development Group,
Tool Designing Dept., Sumitomo Electric
Hardmetal Corp.
"I am working on the development of new
products. My current task is to improve
the design of the Multidrill for even more
accurate machining. I am geared to
developing products that will demonstrate
a significant presence in the world."

"For the Multidrill, we strive to differentiate ourselves from our competitors by aiming at higher efficiency, higher precision and greater depth. This is an unending pursuit. We will continue to aim to further high performance. At the same time, we have worked on the development of new products to acquire more Multidrill users and to place the Multidrill in new markets. From a long-term perspective, I think the Multidrill has completed Chapter 1 and is entering Chapter 2," says Toshiyuki Sahashi.

The challenge of developing new products was assigned to Masaaki Jindai, who had been almost continuously involved in the Multidrill at the Tool Designing Department at Sumitomo Electric Hardmetal Corp. since he joined the company.

Development of a new Multidrill in pursuit of goals ranging from high efficiency to high versatility

High-efficiency-oriented Multidrill has conventionally been used by mass-production manufacturers including automakers. New Multidrill products boldly departed from this way of thinking and targeted flexible machining manufacturers conducting machining primarily using high-speed steel drills.

"Flexible machining manufacturers constituted an extensive market. It was necessary to offer products adapted for selection by them. Therefore, we aimed to develop general-purpose drills to cover a wide range of applications. The key point was to extend their life in low-speed machining, even if their efficiency was compromised. It was a major challenge that required me to draw on all of my experience as an engineer involved in the Multidrill," recalls Jindai.

Before working on the new product, Jindai had a successful experience in developing a Multidrill adapted to Chinese users' needs and launching it onto the Chinese market. He used the knowledge that he had acquired through this experience, such as the



Makoto Abe
Deputy General Manager, Tool Designing Dept.,
Sumitomo Electric Hardmetal Corp.

optimization of cutting edge treatment, in order to develop the new product.

Thus the new Multidrill was created and its production began at Tohoku Sumiden Precision Co., Ltd., which was newly established in Fukushima Prefecture in 2017. Tohoku Sumiden has an IoT-based factory incorporating unprecedented methods of automation, quality control and data management. This was an attempt to tap into a new market for the highly versatile Multidrill. Presently, it is steadily growing in the new market.

"High efficiency and high versatility. When these models of the Multidrill provided by the Sumitomo Electric Group replace the drills currently used in the manufacturing industry, the field of production will undergo further innovation. Envisioning the Multidrill's evolution into smart tools in the near future enabled by IoT in the field of production, I wish to endeavor to provide dependable solutions in the realm of drilling." (Makoto Abe)

Multidrill Paves the Way for Next-Generation Manufacturing

Launching Multidrill to Overseas Markets

Early and wide acceptance of the Multidrill in the European market followed by sales expansion supported by strong patronage

After the commencement of production in Japan in 1984, the launch of the Multidrill into overseas markets began with the export of the product. The sales expansion efforts in the European market were based in Duesseldorf, Germany. Sumitomo Electric Hartmetall GmbH (SHG) was established in 1981 as the sales base for cutting tools in the European market. Supplying the Multidrill to the European market began almost at the same time as in Japan. Moreover, the Multidrill sold earlier and more widely there than in Japan. One of the background factors in enabling this was the presentation of the Multidrill at a trade fair in Germany held when the domestic production of the Multidrill began in Japan. The world's first cemented carbide drill bit for steel machining attracted a great deal of attention. Additionally, the machining environment at manufacturing sites in Germany also had an implication. High-rigidity equipment that can withstand the use of the Multidrill is effective in taking advantage of the true performance of the Multidrill. The proportion of such equipment was high in Germany. When manufacturers tested the product, in many cases they decided to adopt it immediately. The Multidrill received an overwhelming reputation primarily from major automakers and auto parts manufacturers. Against this backdrop, SHG expanded the sales by establishing a full-fledged service framework, such as enhancing the variety of stocked items more than in Japan.

European Union (EU). To respond to growing demand for the Multidrill in Europe and also to overcome the tariff walls of the EC region, building a local production system without delay became a challenge. In 1989, the Sumitomo Electric Group purchased part of a factory owned by a cutting tool manufacturer in Lauchheim, a town in southern Germany, and commenced Multidrill production. It was the first overseas manufacturing site in the Group's tool business. Jun Okamoto took the post of the manager of the local plant. He currently serves as a Senior Managing Director at Sumitomo Electric Tool Net, Inc.

"At the time, Lauchheim was a town with a population of around 6,000. The German staff did not speak English in everyday life. How to establish good communication with them and manufacture products of stable quality was a major challenge. Despite difficulties arising from differences in national character and business customs, I worked patiently and managed the staff to ensure mutual understanding. Moreover, although the Multidrill enabled



Jun Okamoto
Senior Managing Director, Sumitomo Electric Tool Net, Inc.

high-efficiency and high-precision machining at a global level, users were looking for higher specs and performance. In short, we were required to respond to needs for custom-built items. I worked not only on the management of the manufacturing site, but also on accurately identifying user needs and reflecting them in the production site," says Okamoto.

Based in Germany, the Multidrill gained a prominent presence throughout Europe. Based on its explosive sales in Europe immediately after its launch into the market, a similar approach was also taken in the United States. The current high global reputation of the Multidrill started in Germany.



▲ Factory in Germany at the time



Signing the acquisition agreement ▲

Manufacturing site in Lauchheim, Germany with a production framework equipped to fulfill market needs

As Multidrill users steadily grew primarily in Germany and in other areas of the European market, our efforts to shift to local production gained momentum. Around this time, signs were emerging of an end to the Cold War between East and West, and European nations were exploring initiatives for the European Community (EC), the predecessor to the present



▲ Factory in Germany at the time
(left) Masayoshi Matsumoto, present Chairman,
Sumitomo Electric.
(third from left) Tetsuro Kawakami, then President,
Sumitomo Electric
(fourth from left) Jun Okamoto, present Senior
Managing Director, Sumitomo Electric Tool Net, Inc.



▲ Current factory in Germany

Venturing into Global Market

Multidrill sales promotion strategy based in Changzhou and Shanghai

Global Multidrill manufacturing sites deployed in Europe, America, China and Southeast Asia

Multidrill production began with the establishment of the drill manufacturing company Tokai Sumiden Precision Co., Ltd. Subsequently, Multidrill production sites expanded to Europe, America, Southeast Asia and China.

"Our mission is to offer a total solution to drilling by providing the Multidrill, that is, to deliver sound high-quality products to users in a reliable manner, while meeting diverse needs that change with time. My wish is to constantly pursue the provision of Sumitomo quality on a global scale at the mother factory of the globally

expanding network of drill bit manufacturing sites. For this purpose, Tokai Sumiden Precision is vigorously holding workshops for engineers at overseas manufacturing sites and sending technical instructors to them." (Toshiaki Ito)

As described earlier, the overseas production of the Multidrill began in Germany in 1989 and expanded to the United States, Southeast Asia and China. Due to the globally growing demand for automobiles and construction machines, the production and sales performance of the Multidrill is currently very favorable both in Japan and abroad. In Europe, it has shown a stable trend, while in the United States, demand for the Multidrill is rapidly growing because automakers are establishing new plants. Southeast Asia is expected to experience an explosion in demand for automobiles as a result of improving standards of living along with economic development in the future. It has been pointed out that this will lead to growing demand for the Multidrill. Finally, the remarkable area is the huge market in China, which is expanding every year.

Committed to delivering Sumitomo quality based on local production and consumption

In 2011, Sumitomo Electric Hardmetal Manufacturing (Changzhou) Co., Ltd. (SHMC) was founded as a Multidrill manufacturing base in Changzhou, China, which is rapidly growing as a model industrial city. In 2012, SHMC started to operate in full.

"With the basic policy of local production and consumption not only in Changzhou, but also at other overseas manufacturing bases, we aim to manufacture products locally and supply them to local manufacturers and service providers. The production has been successful due to the growing Chinese market, working in our favor due to its favorable economic conditions. However, China's local cutting tool manufacturers are becoming prominent in the area of drilling. Thus, the competition has become increasingly tight," says Koji Yoneoka, President, SHMC.

Under these circumstances, SHMC adheres to the following principle: "For a manufacturing base, the first priority is to deliver products with stable quality, which is a source of competitive advantage."

"The Multidrill is used under various



National staff members actively working at the forefront of sales activities in China

Zheng Cai
General Manager, Market Dept.
Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd.
He manages Tier 2 distributors and plans exhibitions, campaign projects and other sales promotions.

Xinbo Yu
Manager, Engineering Group,
Engineering Dept.
Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd.
He is in charge of workshops and troubleshooting. His service area covers all of China.

Qihui Zeng
Manager, Shanghai Sales Group 2
Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd.
As a sales staff member, he primarily works on providing support to sales agencies.

settings. We are the manufacturer of the Multidrill. We believe that our greatest mission is to enable drilling with stable quality under all kinds of conditions, that is, to provide and maintain the Sumitomo quality. It is also important that the employees share the Sumitomo Philosophy and the Sumitomo Spirit, which is considered to lead to quality maintenance or improvement and also to worksite improvement," says Yoneoka.

Exploring new and enhanced services with sales network throughout China

With its office established in Shanghai, China, Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd. (SHMS) distributes the Multidrill and other cutting tools. The company operates 15 sales branches throughout China and sells products to some 7,000 end user companies through about 50 sales agencies. In this business, technical support is critical.

"The job of the technical staff is to troubleshoot problems. They go to every part of China. They are required to identify the cause of the problem, make an unerring judgment, and solve the problem as soon as possible. Their appropriate and sincere responses help gain trust from users," says Tetsu Fukumori, General Manager, Engineering Dept., SHMS). This business strategy is possible thanks to the support of tool engineering center.

The annual sales growth rate of SHMS has been 10% to 15%, which however, does not mean an increase in market share. The point is how to be

successful in fierce competition with China's local manufacturers. Masayuki Ido, President of SHMS, aims to provide enhanced services unavailable from China's local manufacturers, taking the current opportunity to meet the demand for highly versatile next-generation Multidrills.

"The manufacturing industry is entering the age of Industry 4.0, making the most effective use of IoT.

Tool Engineering Centers (TECs)

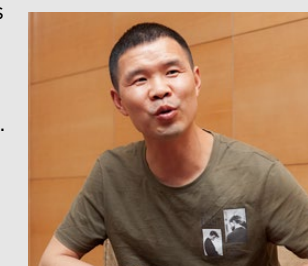
Tool engineering centers, annexed to 12 manufacturing bases in Japan and abroad, support manufacturing conducted at our customers by providing training programs and technical consultations on cutting work that uses the Multidrill and other tools. These TECs offer services extending to manufacturing process improvement, as well as the provision of various lectures by identifying challenges and suggesting ideal solutions for customers' production processes.

The TEC located in Germany is named the European Design & Engineering Center. This TEC is unique in that it has a support system not only for machining, but also for design and development.

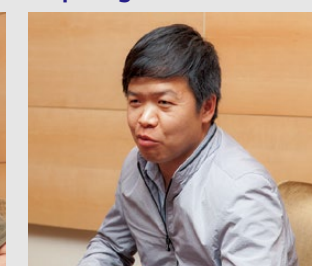


Lecture at TEC in China

Feedback from customers participating in lectures



Mr. Xiaoming Zhu
(auto parts manufacturer)
"Since we began to use Sumitomo Electric's drills, our capacity utilization rate has increased, enabling cost reduction. The lectures were very meaningful for me in terms of taking suitable action to deal with problems."



Mr. Hongyin Liu
(mold manufacturer)
"Sumitomo Electric's drills are four times more efficient than high-speed steel drills. They are revolutionary tools at manufacturing sites. The lectures featuring a variety of topics provided me with beneficial information."



Koji Yoneoka,
President, Sumitomo Electric Hardmetal Manufacturing (Changzhou) Co., Ltd.



Tetsu Fukumori,
General Manager, Engineering Dept., Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd.



Masayuki Ido,
President, Sumitomo Electric Hardmetal Trading (Shanghai) Co., Ltd.



Toshiaki Ito, President, Tokai Sumiden Precision Co., Ltd.

Next-Generation Manufacturing and the Multidrill Toward the Age of Industry 4.0

4th Industrial Revolution originating in Germany

Since its launch to markets in Japan and abroad for about 35 years, the Multidrill has evolved in various ways and played a critical role in innovating the manufacturing site in terms of productivity improvement and cost reduction. Currently, the world is entering a new evolutionary phase of manufacturing. The 18th century saw mechanization enabled by steam power. Mass production began in the early 20th century through the use of electric power. In the 1970s, automation advanced thanks to the use of computers. What is considered to be as influential in scale as these

milestones is "Industry 4.0," an approach leading to the Fourth Industrial Revolution in the history of humanity. The concept is described as a "smart factory" and aims to minimize cost by radically boosting the digitization, automation, and virtualization of production processes. To realize this, IoT is considered to be an effective tool. This tool connects machinery and other equipment used at manufacturing sites via the Internet for the sending and receiving of data to optimize production, supply, and other elements of manufacturing performance. Originating in Germany, these government-led industry-academia-government initiatives have spread to other advanced countries.

As an essential element for next-generation manufacturing, IoT is researched and discussed in various sectors in Japan as well.

Smart tools that give out a cry through sensing and big data

The Sumitomo Electric Group is taking various approaches which are led by the Advanced Materials Laboratory and the IoT R&D Center. The Laboratory creates new materials in the areas of metallic and inorganic materials and process innovation based on the Company's proprietary ultra-high pressure and powder metallurgical technologies. Not only promoting material research but the

Company is also working on processing technologies by collaborating with the IoT R&D Center to develop the "smart tool."

"The tool life of the Multidrill varies depending on its usage and the operating environment. At the end of its tool life, the Multidrill declines in drilling precision and is at high risk of drill breakage as its wear progresses. If a drill breaks during machining, various problems occur. The broken drill pieces are difficult to remove from the hole, the workpiece may be damaged and the following process is delayed. Users wish to use tools to the very end of their tool life, however, it is not possible to predict the end of a drill's tool life because it depends on

Multidrill Paves the Way for Next-Generation Manufacturing



Mitsuhiro Goto,
Executive Officer, Sumitomo Electric/
General Manager, Advanced Materials Laboratory



Daisuke Murakami,
Chief Engineer, Hard Material Research Dept.,
Advanced Materials Laboratory, Sumitomo Electric

the usage and the operating environment. Consequently, it has become a common practice to replace the tool in service with a brand new tool at a safety margin, for example, with around 20% remaining life. As a solution to this challenge, we aim to develop a smart tool that "gives out a cry" to tell the user the end of its life. With this feature, the user can use the tool safely to the fullest extent," explains Mitsuhiro Goto.

To meet this challenge, IoT is absolutely necessary. The concept is to monitor the conditions of the cutting tool by using sensors that detect abnormal force, temperature, and vibration during machining and to predict the end of the tool's life by collecting these data via a wireless network and storing and analyzing them as big data. This concept when realized is expected to substantially reduce the machining and production cost and improve the yield. Daisuke Murakami points out that, due to their nature, drills have many more difficulties to overcome than other tools.

"A drill works at the bottom of a hole. How it is working is not visible from the outside. What is happening there? We are currently working on making it visible. In short, the goal is to visualize it, making full use of sensing and image processing technologies. Visualizing how a drill is working makes it possible to predict the end of its tool life. This in turn reduces waste in production in a smart way," says Murakami.

In more than a few cases, the tool life of a Multidrill has been estimated relying on the senses and intuition of the user.

While the high reliability of this kind of estimation is widely known, smart tools digitalize and automatize the estimation process for further productivity improvement, fulfilling demand in the age of Industry 4.0.

"Drilling is an indispensable part of all kinds of manufacturing. It enables parts to be fitted into an object. Starting with its use in steel machining, the Multidrill has been adapted to diverse materials. Drilling will remain in need in various manufacturing scenes. I hope that the Multidrill will continue to be effective, essential and the first to be selected. The Sumitomo Electric Group aims to be one of the world's top three players in the cutting tool industry within five years. I believe the Multidrill will play the role of a strong engine to make it true," says Atsushi Murayama, General Manager, Hardmetal Div.

There is no doubt that Sumitomo Electric's Multidrill will continue to evolve in the future, help innovate production sites in every part of the world and play a role in paving the way for next-generation manufacturing.



Repeated test cycles assuming all kinds of operating conditions



Young researchers will lead the age of Industry 4.0.

Yasuyuki Shibata

Managing Executive Officer
General Manager, Social Infrastructure Sales & Marketing Unit
General Manager, Power Projects Business Division

1986: Joined Sumitomo Electric
2006: General Manager, West Japan Communications Sales Department
2010: General Manager, Communication Sales Department
2014: General Manager, Sales Planning & Marketing Division
2015: Executive Officer
2018: Assumed his current position

“Business is founded on mutual trust between people. This is why I am committed to our clients to the fullest extent. Such commitment constitutes the Sumitomo Spirit. I believe implementing this spirit leads to solving various social issues.”

Pride in supporting Social Infrastructure.

Striving to make a contribution to the world through our power cable business

Inherited spirit of “profit for others” Our DNA of social contribution

Wishing to contribute to society through infrastructure-building, I joined Sumitomo Electric. I was first assigned to the Power Utility Sales Department in Osaka, and worked as a sales representative in charge of the regional power utility for 13 years. I learned so much from demanding senior colleagues and clients.

I believe that this was when I laid the foundation for my later development which made me what I am today. The fundamental business elements were hammered into me, such as being committed to customers to the fullest extent; being sure to fulfill the promises I made, whether big or small; and seeing through any job until the end.

One of my most memorable job was to establish a power distribution cable system for the opening of Kansai International Airport. It was a project which I was given broad discretion. To ensure the safety of the cables, we had no choice but to transport all the power cables by sea vessel. We also proposed joint delivery with other companies in order to improve efficiency. Thus, not only supplying the products as a manufacture, but also to satisfy the customer’s operational and management needs as well.

I believe today this would be called “a solution provider.” In our ardent desire to commit ourselves to our client, we were very determined. At the end, we accomplished the project successfully.

I also remember how we had contributed to the reconstruction efforts after the Great Hanshin-Awaji Earthquake. Immediately after the disaster hit, we rushed to our clients by bicycle. In the worst afflicted areas in Kobe, where land routes were disrupted we chartered ships to go by sea. Till this day I will not forget when we met with our clients to restore power cables, with aftershocks continuing. Directly observing the reality of the disaster, we felt that we needed to address the situation by any means, propelling us to take action. In addition, we devoted ourselves to satisfying a request from local residents to light up the Kobe Port Tower as a symbol of the restoration from the disaster. There was concern that if the power cables installed on both sides of the bridge to “Port Island” were cut, the entire island would lose power, so we made every possible effort to avoid such failure. Joined by many members of our production team, we worked very hard as a truly united team. These restoration efforts made me keenly aware of the grave significance of the social responsibility for our infrastructure business, as well as our inherited DNA and spirit – “profit for others.”

World’s first cable with heat resistance up to 90°C Meeting global power cable demand

Presently, we are focused to expand our overseas power cable business, where there are a wide variety of needs. For example, overhead conductors and wires are needed in several African countries, which are still in the initial stages in building its power transmission infrastructure, while submarine cables connecting islands are highly in demand in ASEAN countries, and submarine cables for distributing power from offshore wind farms are needed in Taiwan, South Korea, and Japan. Moreover, Europe is currently observing progress in international power interconnections, leading the demand for submarine power distribution cables throughout the world. Amid this situation, how can we enhance our presence? – Our attempts to answer this question have already begun.

One of our epoch-making initiatives was the project of installing a submarine cable between the UK and Belgium (Nemo Link). In addition, we were also engaged in a huge project in India for electricity generated from a hydro power plant in the North to transmitting power to the South, greatly helping to improve the daily lives of local residents.

One of the reasons why our power cables are highly valued lies in its excellent features. Generally, direct current(DC) cables are employed in long-distance transmission lines. Our DC cables feature excellent material properties, enabling continuous use at 90°C, approximately 20°C higher than our competitor’s products, and can also be used for bi-pole* operation. Our cables are the world’s first innovative product that can be used at higher temperatures compared to other cables, and thus realizing smaller conductors which leads to considerable economic and environmental advantages.

We dig deep down to identify our client’s needs before developing our products. Our reputation for having a sincere, earnest attitude combined with technological expertise is gradually spreading all over the world. We have pride as a world-leading manufacturer in long-distance power cable technologies. We also provide power cables for developing countries as well, which help improve the daily lives of local residents. In addition,



we provide support for many European countries as part of their shift to renewable energy. I believe that our efforts are directly connected to helping to solve global-scale issues.

*Switching between positive and negative voltages depending on the operating conditions.

Implementing the Sumitomo Spirit Relationship of mutual trust moving work forward

We are proud that we underpin society by establishing infrastructure, and I feel that this pride serves as our cornerstone. At the time of the Great East Japan Earthquake in 2011, I was responsible for the sales of communication cables. All our related staff devoted their energy to reconstruct the communications network to ensure phones could be used at evacuation centers. Furthermore, when the disaster struck, we had already secured the order to deliver power cables to Russky Island in eastern Russia, where the APEC meeting was held back in 2012. Despite great confusion due to the damage of our manufacturing plant before shipment from the Tsunami, we managed to deliver the products as scheduled by following the Sumitomo style of “being sure to fulfill promises with our clients.” As a result, we received a letter of gratitude directly from our Russian Client’s CEO. I feel that what serves as the cornerstone of our actions is our pride in underpinning infrastructure.

Looking back on what I have done as a businessman over the past 30 years, I found that I have worked with different clients and in different fields, however, I realized there were no changes in how I worked: to always be aware that business is founded on mutual trust between people, that my sincere and earnest attitude will surely strike a chord with my business partners, and that the established relationship will always prevail. This is why I am committed to my clients to the fullest extent. I am convinced that such commitment constitutes the basics of the Sumitomo Spirit, such as *Banji-nissei* (Do your sincere best not only in business but also in every aspect of life), and *Shinyo-kakujitsu* (Place importance on integrity and sound management), and which ultimately leads to solving various social issues.