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Select Japanese Skills

Willing to try and cut anything  
**Ultrasonic cutting technology opens up infinite possibilities**

Photography/Susumu Nagao Text/ Kyoko Ohtsu



Approximately 10 billion sheets of nori are consumed in Japan every year. Nori is laver, an edible seaweed that is compressed into paper-like sheets which are used for making all types of sushi rolls, wrapping rice balls and rice cakes, or shredded as a garnish for soup and other Japanese dishes. It is an integral part of Japanese cuisine.

Over the last ten years, rice balls purchased at convenience stores have increasingly become a regular part of the modern Japanese consumer's diet. Rice balls are a convenient meal, the Japanese equivalent of sandwiches. A handful of rice is shaped into a ball with a mouthful of filling in the center, and wrapped in nori to hold it all together. In the past, the nori used for convenience store rice balls was poor quality and noticeably tough. But from around 2000 onwards there was a dramatic improvement in the quality of these store-bought rice balls thanks to revolutionary changes in the nori used to make them. The nori became easier to bite off, had a better feel in the mouth and tasted better, too. Behind these improvements lies a surprising technology.

Convenience store nori is perforated by countless holes so small you wouldn't notice just by looking. It is these holes—which must be of the right size, shape and spacing—that changed the flavor of convenience store nori and added the extra value.

during the manufacturing process. If the nori is wet or damp it tends to stick like glue, and when powdered nori scatters and clings to the tool making the holes, it dulls the cutting edge. Nori is also a delicate natural ingredient, which will break off into irregular sized pieces if too much force is applied.

These were the difficulties that the Kumakura Corporation's technology helped to overcome. Kumakura, located in Ota Ward, Tokyo, is a small-scale factory proud of its precision parts machining technology. Its main line of business is commissions for advanced micromachining. Why would such a factory choose to develop the technology for processing something so seemingly unrelated as convenience store nori? Well, it would have to be because the company was already thoroughly familiar with nori and its particular quirks.

**The acquaintance with nori began from a whisper**

The story goes back fifteen years. Over drinks one day at a gathering of business people from different industries, someone was heard to sigh over the lack of machines that could easily cut nori. One of the people present overheard this, and could not let it go. That was the current chairman of Kumakura, Ken'ichi Kumakura.

Next morning, he rang the person in the nori industry who had made the comment and was called in that very

same day. The sight that met him at the nori processing plant was one from a bygone world he could never have imagined: the veteran part-time female employees were all cutting the nori by hand. This was also a cause of vexation for their families, as the nori that was scattered in the process stuck to the workers' skin and made it smell. That was how it began, and eventually Chairman Kumakura designed a machine to cut nori. One that could be used by anyone to cut nori in exactly the same way.

At that time things were changing. High-grade nori was no longer selling as an item for the traditional exchange of gifts at New Year and midsummer, and instead there was a shift to demand for industrial-use nori because of convenience stores and conveyor-belt sushi restaurant chains. In line with this demand machines that could cut nori quickly became indispensable. The machine that was developed by Kumakura at this time was eventually adopted by other major nori producers, and now occupies a good 40 percentage of the domestic market share. It is thanks to this machine that consumers can easily buy nori of varying sizes off the shelf.

As for the convenience store nori, the company's success in developing technology to make holes in nori can be attributed not only to having previous experience in developing nori cutting machinery, but also the fact that it excelled at micromachining technology. As mentioned earlier, nori becomes soft

Almost all major nori producers in Japan use Kumakura machines to cut nori. There are machines to cut nori for sushi rolls, flavored nori, gunkanmaki ("warship rolls"), crumbled nori and shredded nori, amongst others. There are also machines that not only cut nori into strips, but also have pattern cutters to make hearts, maple leaves or various other shapes as well. The machines may be slightly more expensive than those of other companies, but many customers come back.

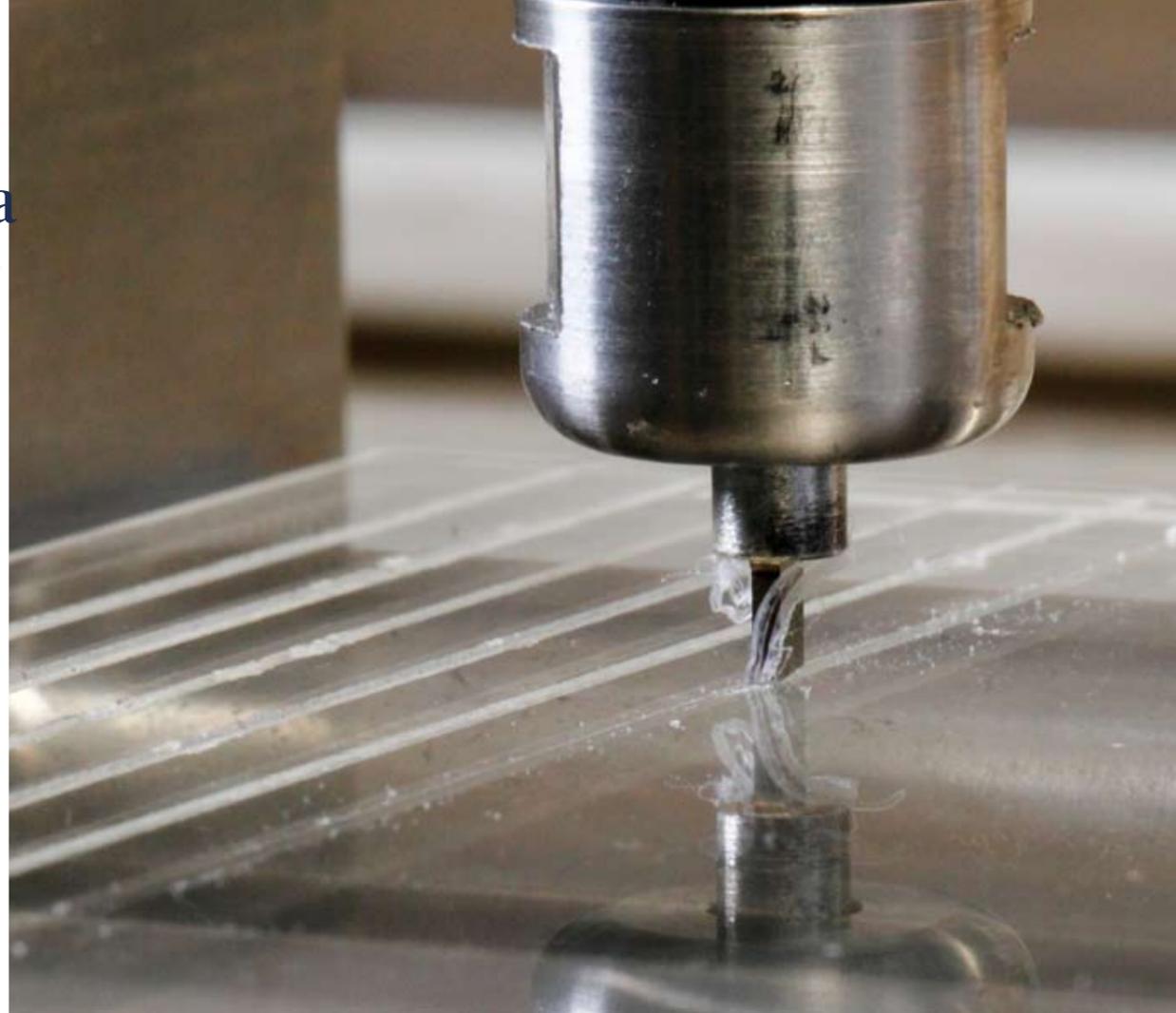


The ∞ Infinity sheet nori perforator. All Kumakura machines are given unique product names by Chairman Kumakura. This machine puts microscopic slit holes in the nori fibers that change the texture of the nori dramatically.



Chairman of the Kumakura Corporation, Ken'ichi Kumakura. His interests are broad and conversation flows freely

## Core technology and a network: essential for developing original products



The latest machinery: a benchtop ultrasonic shaper with a high-rigidity mount ultrasonic knife. Its product name is "skill." This makes it possible to cut out shallow, precise grooves, much like a plane, in materials that had been regarded as difficult to machine or cut. The material and shape of the cutter blade can be changed according to the material to be cut, and it is seen as having great potential for use on different materials and for various purposes. The photograph shows an example of a machine carving out grooves of 5 microns each in resin at 39,000 longitudinal vibrations every second.



Canned corned beef provided the inspiration for the shaper.



A sample of the micromachining that is Kumakura's base technology. (above) Orderly rows of 100 micron holes in the center of tungsten. (right) An example of the ultrasound technology that can be used to create requested patterns on materials of the customers choice, or perforate microscopic holes. The same kind of machining can be used on all kinds of optical glass, fine ceramics and quartz glass.

over time. Even when making holes with a drill-like cone-shaped blade, eventually moisture causes it to clog up. After three years of repeated discussion with nori producers, the company succeeded in making holes in nori through the use of a square blade tip.

### Wide ranging cooperation

Chairman Kumakura was continually thinking about manufacturing the company's original products in order to break away from a dependence on subcontracts from major manufacturers. To achieve this end, he decided that cooperating with other fields and groups was of utmost importance. He created a network that crossed all boundaries and involved the community, industries, universities and research institutes. He showed his face everywhere, made comments and got involved. He stepped into the role of a leader who took up challenges. You can sense his abundance of energy when meeting him face to face. Many of the ideas for the products that Kumakura brought into existence arose

from his exchanges with people in this network. He has a file in which he records muttered comments about whether or not a certain kind of product exists, and is always keeping his ears to the ground. Each comment recorded in this file has columns to include development concepts and outlines, targets, sales strategies and so on. Only those ideas with all columns filled have reached the stage of becoming an actual product. "Is there anything which I didn't turn into a product? Yes, lots. When I look at them now, they're all the ones that make me think, 'Thank goodness I didn't do that one!'" Chairman Kumakura laughed. Another tenet that he sets great store by is refining the company's core technology. The ultrasonic vibration table with the product name "ASSIST" is one original product that the company was able to bring to fruition through innovative applications of its advanced micromachining technology. It began after a visit by Kumakura to the laboratory of a certain university. There he saw students engaged in research on ceramics processing, and when he

witnessed the brittleness of the ceramic material, he immediately announced that the company would cooperate with their research. At the time the company already possessed micromachining technology, but Kumakura was not thinking of working with cutting tools, but rather shaking the piece being worked on. After a process of trial and error, they devised the ultrasonic vibration table. This new technology made it possible to machine microscopic holes and grooves in hard, brittle materials such as ceramics. Careful maintenance and refining of core technologies, interaction with different industries, and practical application of these technologies: this is the Kumakura style. The technology for making holes



This file holds the seeds of countless ideas. "There's even an idea for an automatic plant waterer in there. Plants with not enough moisture say 'water please, water please.' I never made it though..." laughed Chairman Kumakura.

in nori is not limited to nori, but "could be applied also to sheet film and food products," Kumakura explained. When developing a new technology or product he never fails to bear in mind the potential for that "plus alpha" application.

### Technology opens up the future

Kumakura is particularly proud of the latest machine, a benchtop ultrasonic shaper with a high-rigidity mount ultrasonic knife. He gave it the product name "skill." This also had its roots in a conversation with developers from a certain corporation. They were worried about the hazards of working with lithium ion batteries in their research, and looking for measures to get around these issues. Lithium ion batteries are used in many of the electronic devices of modern society, such as computers and mobile phones. However, developers were exposed to great danger when researching them because lithium ion batteries are filled with electrolytic solution, which can ignite or explode if mixed with even the slightest amount of

dust, such as metal powder. Despite this danger, Chairman Kumakura discovered that the reality was that there was no other way to remove the battery exterior other than to gently peel it off. This reminded Kumakura of canned corned beef. The cans are designed to be opened by peeling round and round the side, without leaving anything inside. To achieve this the cut machining applied would stop just before cutting through. Just before—this was the aspect that caught Kumakura's eye. Until then no matter how fine the cut, it would always open a hole. However, there was also another method that could be employed, and that was to slice the material away little by little, like a plane. Using this idea Kamakura devised the ultrasonic shaper, a new technology employing a combination of micromachining and ultrasonic machining. The ultrasonic shaper can etch out a deep groove without producing fragments and shavings or leaving any burrs on the edges. Adjustments to within several microns are possible, and the width and depth of the groove can

also be freely set. It can be used on glass, iron and aluminum, even organic materials and food products. This potential flexibility of use suddenly made it possible to cut machine materials which had previously been regarded as too difficult. Kumakura himself might even machine something that has never been thought of before. He has the potential to open up new technologies for the future, not only for Japan, but also the world.



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