

Stick Around for the New Adhesives

By Morio Murakami

Most people associate high technology with sophisticated supercomputers or high-flying satellites. But the wave of technological innovation is just as important in many other areas that rarely grab the headlines, but often have an even more direct impact on our daily lives. Today, for instance, an increasing number of Japanese enterprises are developing new adhesives for optical disks, only one of the recent breakthroughs in Japan's important adhesives industry.

Although the demand for high-performance adhesives has yet to take off, nearly a dozen companies—like Cemedine Co., a long-established adhesives producer, Sekisui Chemical Co., Ltd., and Denki Kagaku Kogyo K.K.—are rushing into the field. Their targets are new adhesives for bonding substrates and linings, and for coating; they use technologies such as ultraviolet curing, anaerobic, hot-melt and second-generation acrylic adhesives. They have great hopes for the optical disk as a promising information recording medium that someday could replace existing floppy disks and fixed magnetic disks. It is only one example of how Japanese adhesives are being reborn in the "new materials" boom. And the adhesive industry itself is developing into a high-tech business where quality is taking the place of quantity.

One-trillion-yen market

Table 1 gives an estimate of the Japanese adhesive market as it stands today. Although accurate statistics are hard to come by, some estimates put the size of the market at close to ¥1 trillion (\$5 bil-

lion). Of the total, high-performance adhesives are estimated to account for about 10% of the Japanese market, still smaller than in the United States. But judging from the recent activities of Japanese adhesives producers, it will not be long before the share of high-performance adhesives reaches 20%.

Table 1 Adhesive Production in FY 1985 (Estimate for April 1985 to March 1986)

Type	(¥ billion)
Traditional adhesives	117 ^a
High-performance adhesives	100 ^b
Tape or sheet adhesives	60 ^c
Other adhesives	(at least) 100
Total	(at least) 370 ^d

Traditionally, the plywood, woodworking and construction industries have been the "big three" users of Japanese adhesives, accounting for more than 80% of demand. The adhesives they require are mostly synthetic resins: urea, melamine and phenol.

As such, adhesive producers have con-

Notes:

- a. Japan Adhesive Industry Association
- b. Estimate from Japan Adhesive Industry Association poll of 150 member companies
- c. Estimate by Japan Adhesive Tapes Makers Association
- d. Adhesives for in-house consumption, sealants and other compound materials are included.

Table 2 New Adhesives for High-tech Applications

Type	Use
Structural adhesives	aircraft, space, offshore and other equipment
Electroengineering adhesives	IC, VLSI, computers, printed circuits, micromotors, crystal vibrator
Ultraviolet curing, electron beam curing adhesives	space structures, industrial machinery
Ceramic adhesives	automobile engines, medical uses
High-temperature adhesives	space equipment, aircraft, heat exchangers, engines
Low-temperature adhesives	offshore equipment, LNG tankers, space equipment, cryogenic equipment
Nonsolvent pastry adhesives	space equipment, aircraft, underwater equipment, LNG tanks, automobiles
Hot-melt adhesives	electronics, electric equipment, automobiles, nonwoven cloth, industrial machinery
Instant adhesives	electronics, electric equipment, cameras, watches
Two-compound instant adhesives	electronic equipment, precision instruments
Pressure-sensitive adhesives	masking tapes and stickers for electronic equipment and automobiles
Other engineering, high-performance adhesives	optical communications equipment, reproduction equipment, medical uses, reverse osmosis membranes

Sources: CMC Co.'s *High-performance Material Handbook* and others

centrated more on volume than on price. But all three of these industries are experiencing relatively low growth. And with such a limited number of raw materials available for the standard adhesives, there is little room left for developing and using new adhesives for a wider variety of functions. The result, at least up through 1984, was slow and sluggish growth for the industry as a whole.

That gloomy picture lightened up in 1985. Riding on the wave of technological innovation, new applications have been found in microelectronics, optoelectronics, new metals, high-performance resins, industrial ceramics and biotechnology. New synthetic adhesives, well-suited to these needs, have appeared in quick succession.

Today there are new markets and new high-priced adhesives. Whereas adhesives used to be priced by metric ton, now they are being traded for thousands of yen per kilogram. The time has come for adhesive producers to focus on quality rather than quantity.

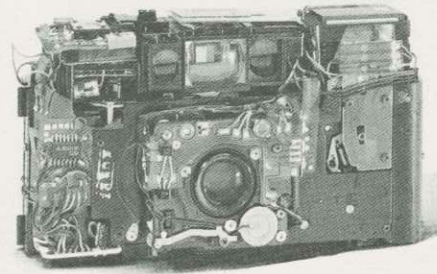
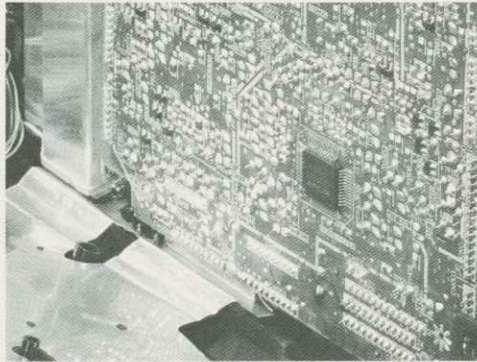
From outer space to inside the body

In the past, Japanese adhesive producers attained the world's highest levels in their output and export of adhesives of the urea, melamine and phenol lineage. Now their production and export of some new high-performance adhesives have also reached world levels. Cyanoacrylate instant adhesives, used widely in bonding parts in electronic and electric machines, cameras and watches, are only one example.

There are other Japanese-developed adhesives that have won world championships and acclaim. Japanese adhesives are being used in motor vehicles, audio equipment and optical communications gear.

To meet the need for strong yet light car bodies and ways to install electronic devices in motor vehicles, auto firms today use compound plastics, high-tensile steel sheet and dual-phase steel sheet. These new materials have created hot demand for structural adhesives, nonsolvent pastry, hot-melt and pressure-sensitive adhesive materials.

In audio gear, adhesives that can gradually reduce vibrations—such as vinyl, ethylene, vinyl acetate and polyamide-based materials—are already in wide use. Structural adhesives—second-generation acrylic adhesives, for instance—are highly resistant to speaker cone paper vibrations.



New adhesives improve the performance of their high-tech customers.

And in optical communications systems, epoxy and polyvinyl butyral optical adhesives are acclaimed for their transparency and reflectivity properties.

"New adhesives are like parts," says an executive at a leading adhesive company. "Adhesives require new materials and new parts. They combine to give birth to high-performance products."

Such cases are familiar in the electronic and aerospace industries. Conductive and pyroconductive adhesives—epoxy adhesives mixed with special filler—have served to improve the performance of electronic machinery. Aerospace equipment, meanwhile, needs strong, light, and temperature-resistant materials. Although Japan now depends heavily on the United States for these materials, new adhesives are now being researched at home, including heat-resistant polyimide adhesives recently developed by Mitsui Toatsu Chemicals. This industry is a promising new user for adhesive products.

Other uses are more down to earth. Adhesives are used in paper diapers and dental treatment. Adhesives are increasingly used in surgery for temporary bondings. Several hours after use, they dissolve in the body and are eliminated as waste.

Table 2 lists some of the latest adhesives in use in high-tech fields. Such adhesives are essential to vessels made from plastic compounds—from rowboats to warships. Ceramic engines and parts, which will debut in the years ahead, also need adhesives.

New adhesives containing sealants and

fillers are even used to manufacture cryogenic equipment in LNG tankers and high-speed railway cars like the Japanese bullet train.

Industry shake-up

"The adhesive material revolution is pressing adhesive makers to solve the problems still standing in the way of their corporate dreams," says Yukitoshi Nonaka, managing director of the Industry-Techno-Economical Surveyors, Analysts and Consultants Group. Nonaka says makers must reinforce their technological development capabilities, set up plants for producing a wide variety of products in small quantities, and select and make available suitable adhesives to their users. Adhesive producers who cannot solve these problems, he warns, are not going to survive the materials revolution.

Today there are an estimated 150 adhesive producers in Japan, most of them traditional, specialized enterprises. They have developed new, high-performance variants of traditional adhesives for plywood, woodworking and construction in an effort to keep up with the changing times. But as the Japanese adhesives industry evolves into an "adhesive materials" industry, major chemical companies and other big businesses will try their hands at this promising new field. A life or death struggle is certain to ensue. Some makers will go under, while others will be merged or taken over. But the result should be a stronger, more innovative industry than before. ●