



HARIMA

CHEMICALS GROUP

COMPANY GUIDE

HARIMA CHEMICALS GROUP, INC.
www.harima.co.jp



Leading the Way with Pine Chemicals

Harima Chemicals Group is a chemical manufacturer built on products developed using pine chemical resources like rosin, fatty acids, turpentine and other materials all obtained from pine trees. We transform those key active ingredients obtained from pine trees into daily essentials.

Our products are used in a wide range of fields from resins for printing inks, paints and adhesives, to emulsifiers for synthetic rubber, chemicals for paper production, and solder pastes for electronic devices. Indispensable everyday products, all derived in some way from the pine tree, are all around us. Printed items such as newspapers, books, catalogues and wrapping papers. Paints used to coat buildings and cars. Adhesives used for bookbinding and packing tapes. Synthetic rubber used in car tires. Various paper-based goods including paperboard and cardboard. Electronic devices such as computers and mobile phones.

And now with an international network of manufacturing bases in 11 countries, we meet the needs of our customers all over the world.



Rosin (Refined)

Rosin

An Ageless Renewable Resource

Rosin is obtained by refining pine tree resin. Pine trees have been used by humans for a diverse range of activities over the ages. The natural sticky property of rosin in rosin bags helps baseball players grip the ball better and violin players creates beautiful sound by stabilizing the bow on the stringed instrument. Anyone who has read the bible may recall how pine resin was used to waterproof Noah's Ark. And the ancient Greeks used it for lighting and in religious ceremonies. Pine resin has been integral to human life for more than two millennium and we continue to make use of rosin in a multitude of modern conveniences that include resin products, various chemicals for papermaking, electronic materials and other useful everyday items.



Working with Pine Chemicals

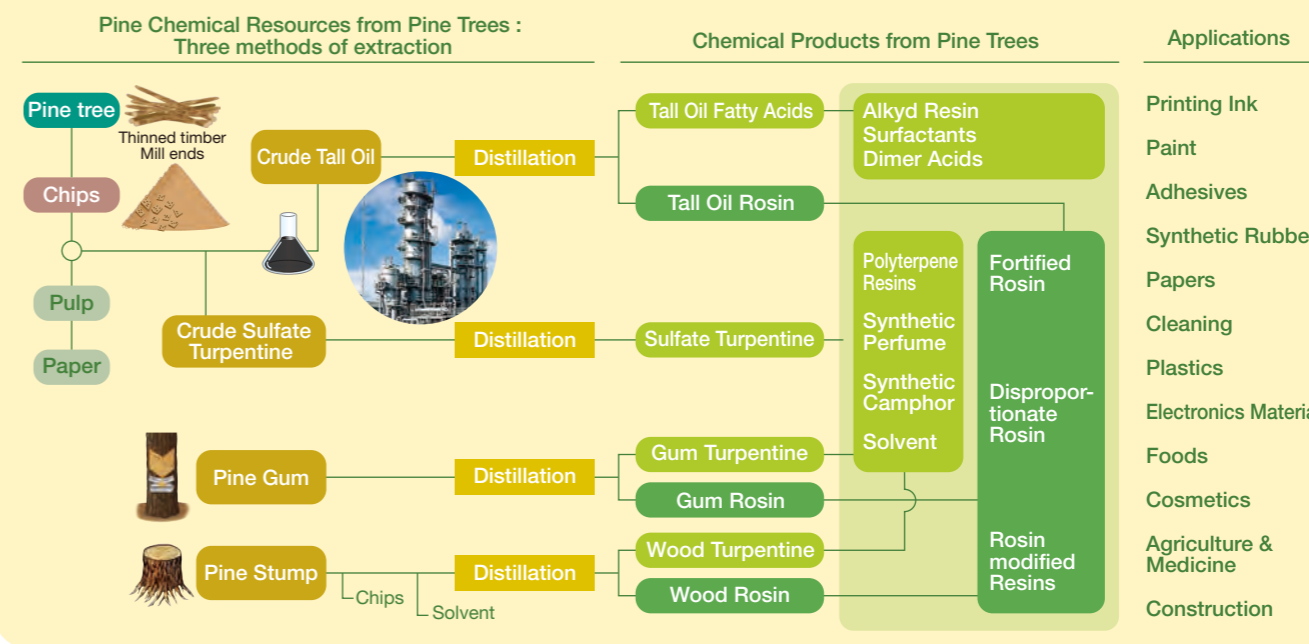
Harima's business was built on pine chemicals.

The term 'pine chemicals' refers to the rosin, fatty acids, turpentine and other useful chemical resources obtained from the pine tree.

We regard the pine tree as a genuine gift from nature and thus, our valued partner.

As such, we seek to find a harmonious balance between technology and nature in efforts to maximize our utilization of the chemical resources it has to offer.

Pine Chemical Products and Applications



Pine Trees Are a Remarkable Renewable Natural Resource

Unlike fossil fuels like oil and coal that will eventually run out, forestation makes the pine tree a truly renewable resource with a life cycle of 20 to 30 years. Our business involves taking the numerous chemical resources offered by pine trees and developing them into an array of products ranging from resin products and the various chemicals used for papermaking, to electronics materials and other useful everyday items.

Types of Rosin

Rosin is classified into three types based on the method of extraction. Gum rosin is obtained from distilling crude gum collected from live pine trees. Tall oil rosin is obtained from distilling crude tall oil* which is a by-product of the craft pulp making process. Wood rosin is obtained by the solvent extraction of wood chips from pine stumps that is then distilled.

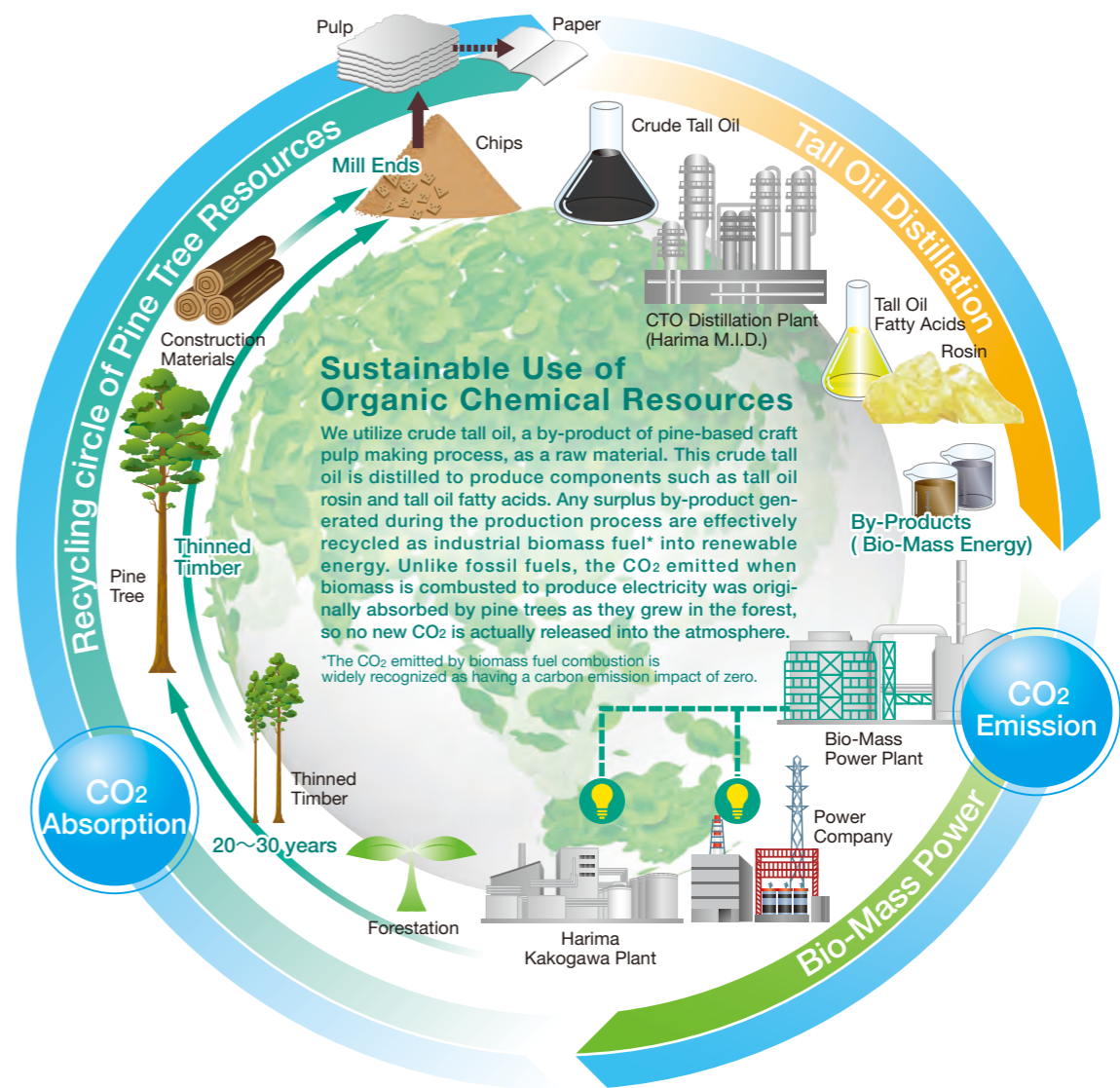
Gum rosin is the oldest and most consumed rosin in the world today. Harima is the only commercial producer of tall rosin in Japan and the leading manufacturer in the pine chemicals field based on the collective use of gum rosin and tall rosin. By effectively managing the use of these two types of rosin depending on their quality and quantity affected by conditions such as weather, we are able to ensure a stable product supply.



*The term tall oil comes from the Swedish word Talloja which means pine oil.

Nature-Born Green Chemistry

Green Chemistry (Green Sustainable Chemistry) is chemical engineering technology that strives to reduce the load on living creatures and the environment for the realization of a sustainable society. From the outset Harima Chemicals Group has worked with chemicals obtained from pine trees, a naturally renewable resource that grow with sunlight and water provided by Mother Nature. Harima has been born and bred as a true green company since its inception. We will continue to promote green initiatives through our strict adherence to low-environmental-impact production technology and eco-friendly products.



Environmental Conservation Aimed at Creating Harmony between People, Nature and Technology

After becoming the first Japanese company to enter the tall oil business in 1958, Harima went one step further in 1973 with the construction of the world's first completely closed tall oil distillation plant that is friendly to both humans and the environment. Furthermore, our main production facility, Kakogawa Plant attained the international standard for environmental management ISO14001 in 2000. Since then, we have actively pursued energy saving measures at all our plants, have worked to reduce industrial waste, and have striven to develop new eco-friendly products as one facet of our comprehensive environmental conservation efforts.



Distillation Plant with complete closed system

Sustainability is Integral to Harima's Corporate Mission

Crude tall oil, the raw material for Harima products is a plant-based biomass resource. We recycle surplus by-products produced during the crude tall oil distillation process as biomass fuel. In addition to steam production using a boiler, we have built our own biomass power plant at Kakogawa plant in March 2005 to meet the entire facility's steam and power needs. Any surplus energy generated is supplied to a local power company as green energy.



Bio-Mass Power Plant

Pioneering R&D Work Creating New Value

Based on long-term strategies, Harima's R&D objectives constantly challenge us to pioneer new product values and rapidly transform the research results and technology into marketable products.

We will continue to meet ever-changing market needs, always ready to challenge new and unexplored realms with an eye on the future.



Central Research Laboratory
(Kakogawa city, Hyogo)



LAWTER - Elgin (U.S.A.)



Tsukuba Research Laboratory
(Tsukuba city, Ibaraki)



LAWTER - Kallø (Belgium)

Creation of New Technology through Human Resource Development and Vitalization

Harima has successfully created a research climate that encourages originality through the development of superb human resources and corporate vitalization. A number of educational training opportunities, international exchanges, and overseas dispatch programs are in place to encourage active collaboration with authoritative research institutes both domestically and internationally. A special award system has also been initiated to recognize and reward excellent research to motivate talented researchers. Not stopping there, we promote interaction with other industries, as well as with academic, business, and governmental circles in ongoing efforts to nurture outstanding researchers who will develop the next-generation of technology.

We Focus Attention on R&D with an Eye on the Future

Harima actively incorporates leading-edge technology into the development of new products that are harmonious with nature, energy-saving and ecological. Tireless research efforts bear fruit in the form of the many patents and diverse products in our lineup for which we receive widespread domestic and international recognition. Our Central Research Laboratory in Kakogawa and Tsukuba Research Laboratory in the heart of Tsukuba Science City form the backbone of domestic R&D activities. Armed with the latest research facilities and analytical equipment, researchers are free to push the boundaries of current knowledge in pursuit of science that is many years ahead of its time. R&D efforts received a significant boost in 2011 with the addition of Lawter, and its research facilities located in the United States, Belgium, The Netherlands and China. Harima Chemicals Group is now in a better position than ever before to closely collaborate in meeting the demanding needs of an ever-changing world market with globally aligned R&D. Our unique technology born of passion and dedication is the driving force behind a more affluent lifestyle for all.

Contributing to a Safer and more Beautiful Lifestyle

Harima's resins and tall oil products business taps into its abundance of advanced technologies and know-how to satisfy the numerous functional and performance-related demands of the printing inks, paints, adhesives, synthetic rubbers and various other consumer items. The addition of Lawter to Harima Chemicals Group in 2011 facilitated the organization of a broader global distribution network for our core products in these fields: printing ink resins, adhesive resins, and synthetic rubber emulsifiers. As a leading manufacturer of these products, we offer people around the world a safer and more beautiful lifestyle.

[Business and Products] Harima Technology is all around us

| Printing Ink Resins | Paint Resins | Adhesive Resins | Synthetic Rubber Emulsifiers

Printing Ink Resins

Printing inks used to display information and colors in newspapers, magazines, flyers and posters mainly consist of a variety of colored pigments, synthetic resins used to uniformly disperse and adhere these pigments to media such as paper, and solvents which regulate the ink's fluidity. By combining the rosin's superb pigment dispersing property with phenolic resin's excellent adhesive property through our uniquely developed technology, we have developed new rosin modified phenolic resins. The resins in this series possess such features as easy solubility, quick-set, stable emulsion of printing ink as well as eco-friendliness. With these competitive ink resins spread widely, we have gained a leading share of the global market. We will continue to refine the rosin modification techniques we have cultivated since the company's beginning in pursuit of even higher quality printing ink resins for the realization of innovative eco-friendly printed material that is safer, more vivid, and capable of printing at higher speed and lower cost.



Adhesive Resins

Natural stickiness of rosin makes rosin derivatives an ideal adhesion enhancer when added to adhesives and pressure sensitive tapes. By adjusting the type and quantity of rosin derivatives (tackifiers), it is possible to give adhesives a variety of special properties. We offer customers around the world a diverse range of rosin-based tackifier resins and tackifier dispersions to meet their every purpose and need.



Overview of LAWTER

The pioneer of quick-set printing inks Daniel J. Terra and his financial partner J. Lawson founded Lawter Chemicals in Chicago in 1940, the name Lawter being a combination of their last names Lawson and Terra. The company went on to expand its business in America and Europe as Lawter International Inc., eventually establishing itself as a leading global manufacturer of printing ink resin. The name Lawter all but disappeared after successive acquisitions by Eastman Chemical Company in 1999 and then Momentive Specialty Chemicals (previously Hexion Specialty Chemicals) in 2004 until Harima Chemicals acquired it in January 2011. The well-known LAWTER brand was subsequently reestablished and the company was returned to its rightful position as a leading global player.

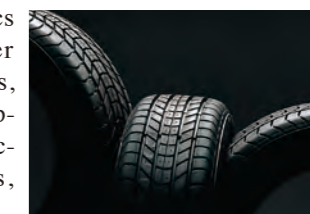
Paint Resins

Paints are used to protect various objects from rust and deterioration and to enhance the appearance of all kinds of man-made objects ranging from automobiles, industrial products and buildings, to small everyday items. Paints comprise three main components: pigments which give colors, synthetic resins which provide adhesion for these pigments to the target substrate and doubles as a surface protector, and solvents used to regulate the paint's viscosity. Harima offers an extensive lineup of fully customizable purpose-specific paint resins designed to meet customers' needs whether it be sealers for direct application to surfaces such as metal, plastic and concrete, intermediate coating for recoating, or top coating for weatherproofing and beautification. Recently, we are vigorously pursuing the development of eco-friendly products with less Volatile Organic Compounds (VOC) such as high solid paint resins and water-based paint resins.



Synthetic Rubber Emulsifiers

One method of manufacturing synthetic rubber is emulsion polymerization. Emulsification is a technique involving the dispersion of insoluble substances in water, and rosin's natural chemical structure makes it an ideal emulsifier. Our rosin-based synthetic rubber emulsifiers have contributed greatly to improvements in the performance of automobile tires, many of which commonly incorporate a synthetic rubber called SBR (styrene butadiene rubber). Rosin-based synthetic rubber emulsifiers are also vital in the manufacture of CR (chloroprene rubber), a synthetic rubber boasting many characteristics which are not seen in other natural and synthetic rubbers, such as low flammability. Applications of CR include electric wire, automobile parts, driving belts, and adhesives.



Improving the Quality of the Paper We Use Everyday

Harima products known as paper chemicals are utilized in a large number of everyday paper items. We offer a wide array of products including sizing agents for preventing (water-based) inks from bleeding, paper strengthening agents for structural fortification, and coating agents for improving and reinforcing paper surfaces. Another priority we are pursuing is engineering innovative new chemicals such as those for reducing what would have been wasted paper by increasing the recycling rate of used paper.



[Business and Products] Harima Technology is all around us

| Sizing Agents | Paper Strengthening Agents | Coating Agents & Chemical Specialties

Sizing Agents

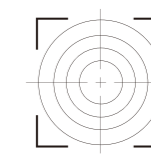
Sizing agents control the water absorbency of paper to prevent ink bleed and thus provide good writing performance and printability to the paper. The high water repellency property of rosin makes it a useful sizing agent in its natural state. However, we use independently developed techniques to further refine rosin and produce sizing agents specifically customized to a diverse range of paper manufacturing processes. Rosin sizing agents are generally referred to as internal sizing agents, something that is added to the pulp and water mixture (raw material) during the papermaking process. In addition to internal sizing agents, we also engineer, manufacture and sell surface sizing agents applied to surface of the finished paper.



Comparison of water-based ink bleed



Without sizing agent



With sizing agent

Paper Strengthening Agents

Used paper has become a common ingredient in the raw materials for newspapers and paperboard known as recycled papers. Paperboard, which is to become corrugated cardboard, and newspapers rank first and second of all paper products in recycling ratio. However, repeated use reduces the strength of recycled paper. Paper strengthening agents have the important task of strengthening paper-based products containing a large percentage of used paper. The main constituent of these agents are water-soluble polymers. We have successfully applied our unique water polymerization techniques acquired over many years to engineering highly functional paper strengthening agents that improves the strength of paperboard and newspapers. As is the case of sizes, these agents can be added during the papermaking process or to the paper surface. We are proud to play a part in improving the quality of paper products with our vast lineup of paper chemicals tailored for specialized manufacturing processes.



Coating Agents & Chemical Specialties

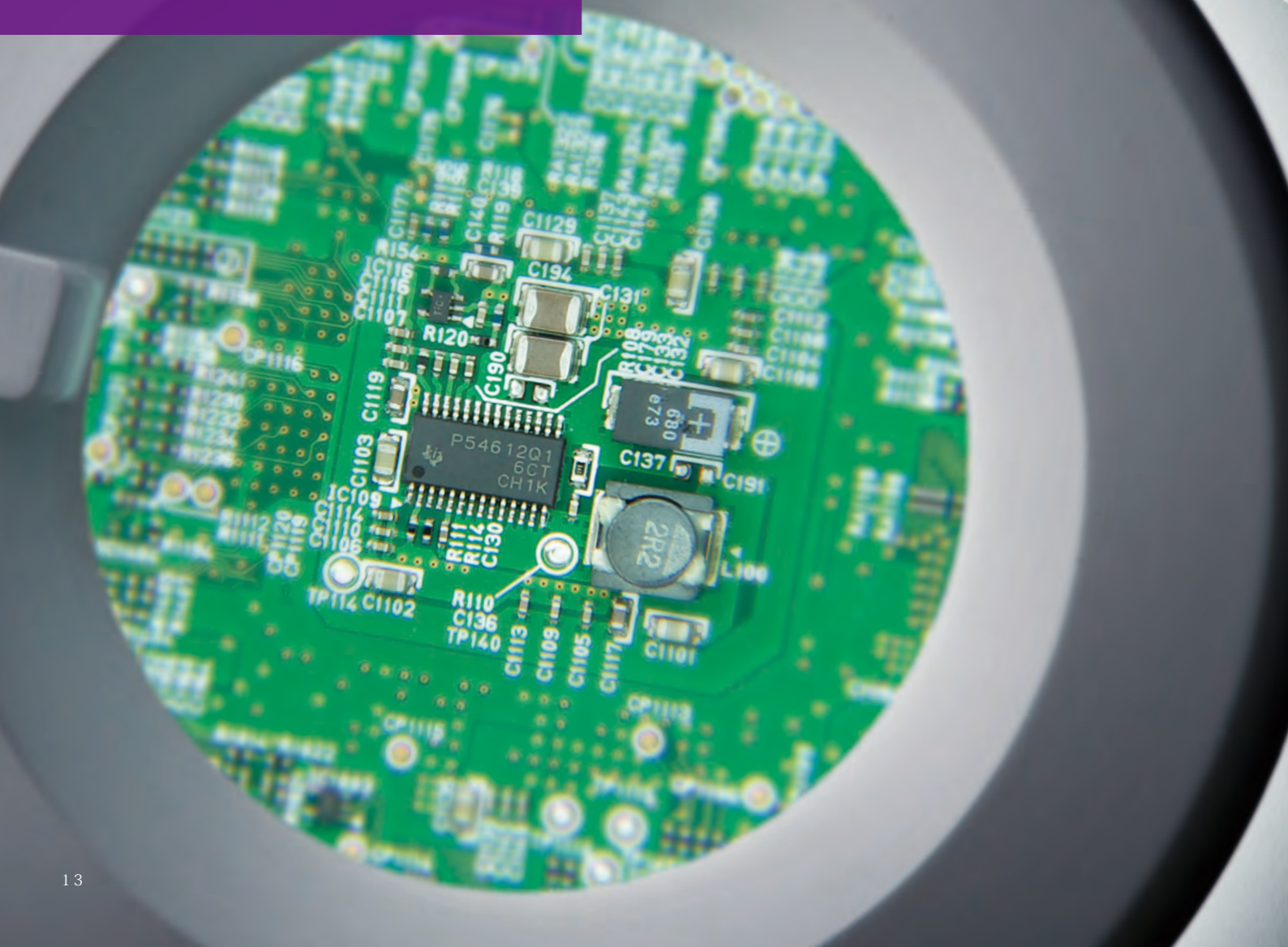
Coating agents are applied to the surface of finished paper products to enhance their performance. Our extensive portfolio of coating agents can effectively enhance anti-slip capacity, water repellency, water resistance, and printing density for inkjet printing, among their many applications. We also engineer specialized products such as the retention aid which is added during the recycling process to suppress the generation of waste products and increase yield.



Making Safer, more Evolved Electronic Devices

Harima's electronic materials business covers the development, manufacture and sale of items like solders and conductive pastes used to mount microchips and form electronic circuits for today's increasingly compact high-performance electronic devices.

Harima technology can be summed up as one that is both Clean (eco-friendly) and Fine (compact and highly functional). We conduct our daily business activity with this philosophy in mind and bring value-added proposals to customers. Whether it is the low-cost micro soldering technologies that contribute to miniaturization, or independently developed multifunctional materials capable of shortening the production time of electronic devices, we offer the latest innovations.

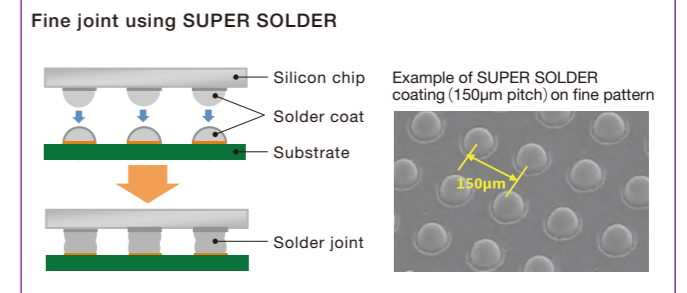


[Business and Products] Harima Technology is all around us

| Solder Pastes | Conductive Pastes | Aluminum Brazing Materials

Solder Pastes

Solder is a material used to form a joint between electronic parts and substrates during the manufacture of electronic devices such as mobile phones and computers. One variety called solder paste is a creamy mixture of fine metal powder and other materials which include rosin. We have applied the decomposing effect of rosin on metal oxides to develop unique solder pastes by mixing metal powder with rosin derivatives. We believe it is our duty to protect the environment, and as such were one of the first to develop lead-free solder pastes as a means to prevent the devastating impact that lead has on the environment when it leaches from old or discarded electronics due to acid rain. Ever since our lead-free solder pastes were used to produce the world's very first lead-free MD player in 1998, it has become widely adopted.

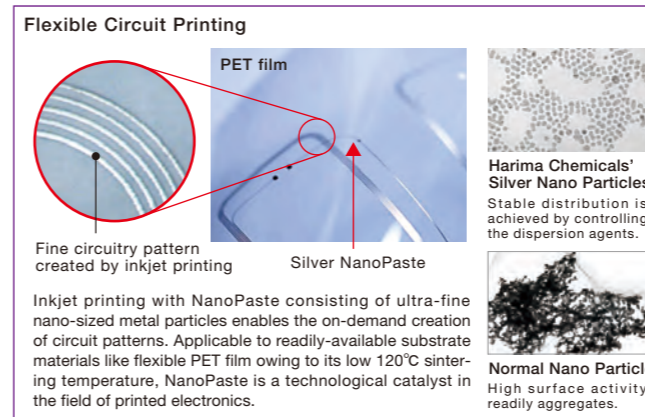


<SUPER SOLDER>
'SUPER SOLDER' pastes excel at joining extremely small parts. Our unique solder pre-coating technology that supplies SUPER SOLDER to fine joints is expected to play an increasingly vital role in manufacturing tomorrow's miniaturized electronic devices.

Conductive Pastes

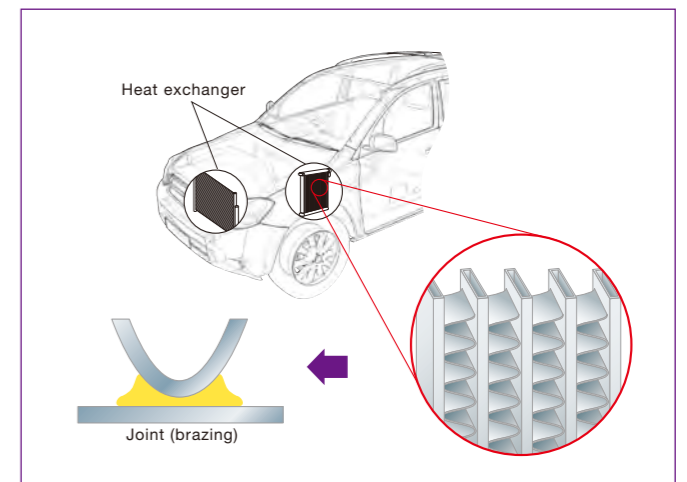
Conductive paste is, as the name suggests, an electrical-conductive adhesive. Harima's extensive knowledge acquired in the fields of coating and adhesion resins has made it possible for us to create conductive pastes that, for example, facilitate the release of heat generated by electronic devices (thermal conductivity) to allow for higher density of parts to be mounted. Also characterized by its high reliability and compatibility with various printing methods, conductive pastes have become an indispensable soldering material in the parts assembly of next-generation electronics devices such as solar cells and smart phones. Another of our conductive pastes is NanoPaste, a stable distribution of nano-sized* metallic particles in ink-form that only needs to be applied and heated to form a highly reliable metallic membrane for a wide-range of joint and wiring applications. NanoPaste's applicability to various printing methods, including inkjet, has made it a prime candidate as a core material in the area of printed electronics.

*Nano-size denotes one billionth of one meter.



Aluminum Brazing Materials

Brazing technology used to join aluminum is another application of Harima's extensive know-how. Aluminum brazing materials used in the manufacture of all kinds of aluminum products contribute to enhanced quality and reduced costs. Aluminum is commonly employed as a weight-saving measure in heat exchangers, which are an essential part of engine cooling and air conditioning in automobiles, making it necessary to braze aluminum parts of varying shapes together. Conventional manufacturing methods involved spraying the materials needed for brazing on to the entire surface of heat exchanger member and then heating. However, the aluminum brazing material we engineered is an extension of our pre-coating technology and only requires that a minima amount of brazing material be supplied just to the immediate brazing area, realizing drastic cost reductions and higher quality.



■ Company Overview

Company name	Harima Chemicals Group, Inc.
Founded	November 18, 1947
Representative	Yoshihiro Hasegawa, President
Tokyo Head Office	3-8-4 Nihonbashi, Chuo-ku, Tokyo, 103-0027, Japan TEL +81-3-5205-3080
Osaka Head Office	4-4-7 Imabashi, Chuo-ku, Osaka, 541-0042, Japan TEL +81-6-6201-2461
Capital Stock	10,000 million yen
Listing	Tokyo Stock Exchange
Employees	(consolidated) 1,500
Business Description	Manufacture and sale of products developed using pine chemical resources such as rosin, fatty acids and turpentine.

■ Company History

Nov. 2018	Acquired shares in SunPine AB
Jun. 2016	SunPine's tall oil rosin plant started full operation, at an annual capacity of 20,000 tons
Dec. 2015	SunPine's tall oil rosin plant started trial operation LAWTER is a shareholder in this business
Dec. 2014	Takasago-Iho Solar Power Plant completed in Takasago, Hyogo
Nov. 2014	Completion of Nanoparticle Factory at Kakogawa Plant
Jun. 2014	LAWTER invested in a tall oil rosin production business in Sweden
Oct. 2012	Trade name changed to Harima Chemicals Group, Inc. (holding company) Business matters taken over by newly established Harima Chemicals, Inc.
Jun. 2012	The Establishment of Harima Chemicals (Shanghai) Co., Ltd.
Apr. 2011	LAWTER Global HQ established in Chicago, USA
Feb. 2011	Production start at Dongguan Hanghua Harima Paper Chemicals Co., Ltd.
Jan. 2011	Acquired rosin base resin (IAR) business of Momentive Specialty Chemicals, Inc to establish Lawter
Dec. 2009	Harima made Xinyi Rihong Plastic Chemical Co., Ltd., its owned subsidiary
Oct. 2009	Harima made Nippon Filler Metals, Ltd. its owned subsidiary
Feb. 2007	Established Harimatec Czech, s.r.o. (Czech Republic)
Jul. 2005	Established Nanning Harima Chemicals Co., Ltd. (China)
Mar. 2005	Harima launched the biomass power generation system utilizing a by-product as fuel, produced from tall oil distillation
Dec. 2003	Established Harimatec Malaysia Sdn. Bhd. (Malaysia)
Sep. 2003	Established Harimatec Inc. (USA)
Feb. 2003	Established Harimatec Hangzhou Co., Ltd. (China)
Aug. 2002	Completion of electronic materials production facility at Kakogawa Plant
Jun. 2000	ISO 14001 certification achieved (Kakogawa Plant)
Jun. 1999	ISO 9001 certification achieved by entire company
Oct. 1997	Established Hangzhou Hanghua-Harima Paper Chemicals Co., Ltd. (China) (in present-day Hangzhou Hanghua Harima Chemicals Co., Ltd.)
Apr. 1996	Harima obtained a sole ownership of Plasmine Technology to make Plasmine owned a fully subsidiary
Sep. 1990	Relisted on first section of the Tokyo and Osaka stock exchanges
Apr. 1990	Name changed to Harima Chemicals, Inc.
Mar. 1989	Listed on the second section of the Tokyo stock exchange
Nov. 1985	Listed on the second section of the Osaka stock exchange
Mar. 1983	Shorai Foundation for Science and Technology founded
Feb. 1980	Established Harima USA, Inc. (America)
Aug. 1974	Established Harima do Brasil Indústria Química Ltda (Brazil)
Aug. 1973	Completion of world's first tall oil closed-system plant
Jan. 1972	Harima M.I.D., Inc. founded
Oct. 1958	Completion of Japan's first tall oil distillation plant
Nov. 1947	Harima Kasei Kogyo KK founded (in present-day Kakogawa, Hyogo prefecture)



Takasago-Iho Solar Power Plant



Biomass Power Plant



Present tall oil distillation plant

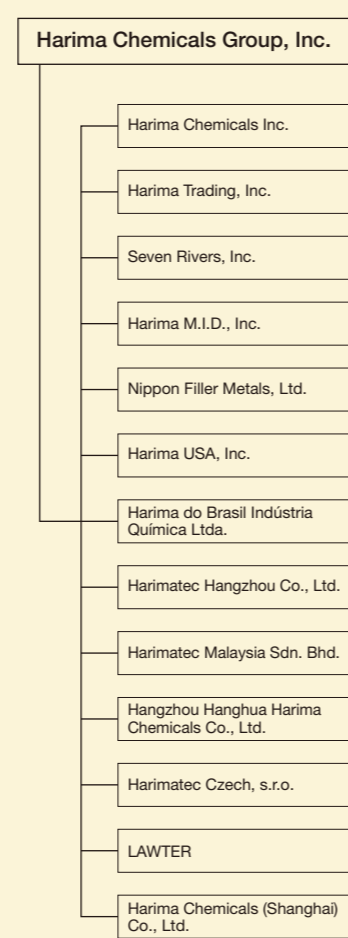


First domestic tall oil distillation plant (1958)



Distiller at Kakogawa Plant (around 1952)

■ Holding Company Structure



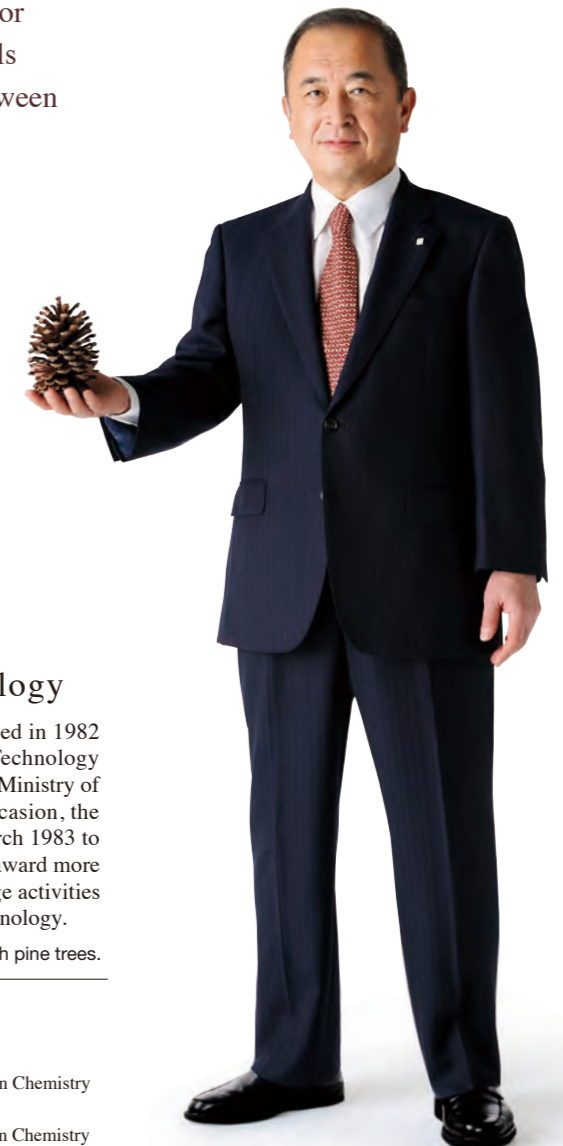
A Symphony of Future Prosperity Played by Humans and Nature That is our Wish at Harima Chemicals

Harima Chemicals Group has consistently utilized its wealth of accumulated know-how to effectively transform chemical resources obtained from the natural pine tree into value-added products for the enrichment of people and industry. Our innovative lineup, a result of dedicated R&D since Harima's foundation in 1947, has been the driving force behind our constant success as a world-renowned pine chemicals manufacturer. We will continue to promote global business development, both domestically and overseas, as an advanced eco-friendly corporation who considers the earth to be one field. Furthermore, the establishment of the Shorai Foundation is the materialization of our wish to assist in the advancement of science and technology.

The essence of our work at Harima is summed up by our basic philosophy: "Live a better life with what nature provides."

It is our sincere hope that we can further enrich people's lives in harmony with nature and technology while pursuing the creation of a more prosperous society. With this firmly in mind, we will continue our endeavor to become a global leader in the field of pine chemicals by further deepening and maximizing the synergy between all companies within the group.

President
Yoshihiro Hasegawa



Shorai Foundation for Science and Technology

Harima's long-standing achievement in tall oil operation was recognized in 1982 when Harima's founder Sueyoshi Hasegawa received a Science and Technology Award from the Ministry of Science and Technology (now known as the Ministry of Education, Culture, Sports, Science and Technology). To mark this occasion, the Shorai* Foundation for Science and Technology was established in March 1983 to promote science, technology as well as world culture. It has gone on to award more than 600 million yen in research grants to date to subsidize and encourage activities including research, study and international exchanges in science and technology.

* "Shorai" means wind, or the sound of wind, blowing through pine trees.

Two researchers awarded research grants through the Shorai Foundation have gone on to win the Nobel Prize.

- ◇Dr. Ryoji Noyori
Recipient of 1986 (4th Annual) Shorai-Research Grant Awarded 2001 Nobel Prize in Chemistry
- ◇Dr. Akira Suzuki
Recipient of 1991 (9th Annual) Shorai-Research Grant Awarded 2010 Nobel Prize in Chemistry