

Developing the technologies needed for a smart society: ULVAC announced its PZT piezoelectric thin-film sputtering technology for next-generation MEMS sensors/actuators, and began selling systems for use in mass production.

— ULVAC, Inc.



Sputtering system SME-200

In July 2019, ULVAC, Inc. announced its proprietary PZT piezoelectric thin-film mass-production technology, based on a low-temperature sputtering process the company had been developing as a contribution to next-generation MEMS technology. ULVAC has begun selling systems for use in mass production.

PZT piezoelectric thin-film mass-production technology is crucial to the fabrication of micromirror devices (optical devices) for use in VR, AR, and MR systems, as well as in LIDAR devices, all of which support a smart society. Vast improvements in reliability have made device commercialization possible, and by optimizing equipment operation, we have reduced running costs. We have now begun selling systems that incorporate the world's most advanced mass-production technology.

This technology makes it possible to reduce the size and power consumption of MEMS devices, improve their performance, decrease their production cost, and integrate them with semiconductors (CMOS). This integration is expected to expand the potential for use of MEMS devices in sensors and



actuators used in spacial information sensing and 3D image displays.

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**ULVAC-Osaka University Joint Research Laboratory for Future Technology opened on the Osaka University campus**

— ULVAC, Inc.

On November 1, 2018, ULVAC, Inc. and the Graduate School of Engineering at Osaka University established the ULVAC-Osaka University Joint Research Laboratory for Future Technology (hereafter referred to as the “Joint Research Laboratory”) in the Central Terrace Building of the University’s Suita Campus.

Through Osaka University’s industry-academia



Central Terrace Building at the Suita Campus of Osaka University

collaboration framework, the Joint Research Laboratory aims to 1) promote mutual exchange among researchers and build an R&D network, 2) contribute to scientific advancement and the resolution of technical issues in the medical engineering field, and 3) develop highly creative university human resources. By positioning the Joint Research Laboratory as a key location for conducting basic research, ULVAC aims to employ its own in-house technologies to create new value, which include applications for next-generation FPDs, creation of semiconductor quantum dots for use in artificial photosynthesis, and ultra-high-speed freeze-drying technology for medical applications such as cell preservation.

**Research themes**

- (1) Development of cryogenic regenerator material using rare earth nitrides
- (2) Development of alloy powders with controlled anisotropy and material
- (3) Establishment of a cell preservation method that uses ultra high-speed freeze drying technology

**Research organization**

**Director:** Prof. Takao Yamamoto (Osaka University, Graduate School of Engineering)

**Assistant Director:** Dr. Hirohiko Murakami (General Manager and Senior Fellow of ULVAC’s Future Technology Research Laboratory)

Eleven people total: the two listed above along with instructors and researchers (including part-time staff)

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**In appreciation of Chigasaki:  
 ULVAC Global Festival 2018**

— ULVAC, Inc.

On Saturday, November 10, 2018, ULVAC Global Festival (ULFes) 2018 was held for the second year in a row at the ULVAC, Inc. Head Office/Plant. It is becoming an annual event.

Since 2018 marked the 50th anniversary of the 1968 completion of the Chigasaki Plant, “In appreciation of Chigasaki” was selected as the theme of this ULFes. Executive committee members, consisting mostly of new employees, were put in charge of planning and operation, and their youthful energy and creative ideas made ULFes a lively event slightly different in style from the previous year. Activities included the Gourmet Grand Prix skillfully hosted by ULVAC group companies, performances and stage events by local junior and senior high school students, factory tours, vacuum experiments, and a giant raffle, all of which were very popular with both children and adults.

It was a warm, sunny autumn day and approximately 5,000 visitors attended. The festival went very smoothly, thanks to the generous support and collaboration of all participants and sponsoring organizations.

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People enjoying the festival



Mascot characters drawing cards at the Giant Raffle (left), vacuum cannon demonstration (right)



**Liquid nitrogen generator donated to the Giant Panda Breeding Research Base in Chengdu, China**

— **ULVAC CRYOGENICS INCORPORATED**



President Takeshi Haginouchi of ULVAC CRYOGENICS INCORPORATED (left) and Vice Chairman Wang Gesheng of the Giant Panda Breeding Research Base

In November 2018, ULVAC CRYOGENICS INCORPORATED held a ceremony to donate a liquid nitrogen generator to the Giant Panda Breeding



Liquid nitrogen generator

Research Base in Chengdu, China. The generator is capable of easily generating liquid nitrogen from the ambient air.

At the ceremony, President Takeshi Haginouchi of ULVAC CRYOGENICS INCORPORATED personally presented the document describing the donation.

In response, Vice Chairman Wang Gesheng of the Giant Panda Breeding Research Base expressed his appreciation, saying, “For the time being, we will use the donated liquid nitrogen generator to preserve panda sperm, eggs, cells, etc., but eventually we would like to use it to protect and breed endangered animals besides the panda.”

In 2009, ULVAC CRYOGENICS INCORPORATED began selling 4K cryocoolers in addition to conventional cryogenic pumps. In 2014, it bought out the products of the Low-Temperature Equipment Division of Iwatani Industrial Gases Corp., moving itself definitively into the low-temperature equipment business. Since the liquid nitrogen generator is a versatile product, it is expected to be used in a wide range of fields, and the recent donation for the purpose of protecting an endangered animal species represented a significant social contribution.

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**Recognized in FY2019 as a “White 500” company for the second consecutive year by the Ministry of Economy, Trade and Industry**

— **ULVAC, Inc. and its group companies**



Public health nurse Kamio (ULVAC Health Insurance Society) (left) and public health nurse Ohira (ULVAC)

Just as in FY2018, ULVAC, Inc. was recognized in FY2019 as a “White 500” company (in the large-company category) for its outstanding health and productivity management. The award was given jointly by the Ministry of Economy, Trade and Industry (Japan) and Nippon Kenko Kaigi. This fiscal year, ULVAC EQUIPMENT SALES, Inc. of the ULVAC group was also recognized as a White 500 company in the small- and medium-sized enterprise category.

The White 500 Recognition System was designed to acknowledge companies of all sizes for their outstanding efforts in health and productivity management, based on initiatives addressing local health issues and the health-promoting initiatives advocated by Nippon Kenko Kaigi.

In the belief that ULVAC can only create value when all employees are healthy and energetic in mind and body and demonstrate their fullest potential, the ULVAC group is working to foster health that supports manufacturing.

As part of this initiative to create a workplace where all employees pursue their dreams, enjoy what they do, and always look forward to coming to work, we are implementing a variety of projects. These include an organizational revitalization pro-

gram led by our company executives and managers, an event that measures physical strength correlated with age, an on-campus multi-stage relay race, and an inter-departmental walking contest. As a result, the number of employees who walk regularly has been increasing each year, and the difference between our company’s Health Age® and actual age has reached -2.86. Additionally, health surveys of our employees have shown that the number of employees who work energetically has been increasing each year. It was found that regular exercise helps employees feel stronger, more alert, and more willing to take on challenges.

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**UL-fit RUN! Long-distance Relay Race held at the Head Office/Plant**

— **ULVAC, Inc.**

As part of its efforts to create an environment in which all employees pursue their dreams, enjoy

what they do, and always look forward to coming to work, ULVAC, Inc. held the First UL-fit RUN! Long-distance Relay Race as a White 500 recognition commemoration event at the Head Office/Plant site on February 9, 2019.

Although the event was held in the dead of winter, no snow fell that day. A total of 97 ULVAC group employees from 14 teams competed in the race, fostering communication that transcended departmental and company boundaries. In a questionnaire-based survey following the event, 97.1% of the participants reported that the race had been a positive experience for them and that it had increased their perception of unity in the workplace.

Since the positive feedback exceeded organizers’ expectations, a second relay race is already being planned in the hope that even more employees will participate.

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97 people participated from group companies and partnering companies



Heated competition in cold weather



Building unity in the workplace

**Oxford Instruments (UK) and ULVAC collaborate to provide atomic-scale processing solutions to Japan's power device and RF device markets**

— **ULVAC, Inc.**

In January 2019, ULVAC, Inc. concluded an agreement to become a Japanese distributor for Oxford Instruments Plasma Technology (OIPT, a trading name of Oxford Instruments Nanotechnology Tools Limited, Oxford, UK). This was an important step towards collaboration between the two companies.

OIPT began operating in Oxford, UK in 1959 as a commercial spin-out company from Oxford University. Three years later, the company succeeded in commercializing the world's first superconducting magnet. More recently, OIPT has developed an atomic-force microscope incorporating cutting-edge technologies and enhanced solutions based on super high-sensitivity digital cameras. It is actively pursuing innovations in a wide range of fields, from solid-state physics, materials, and bioscience to earth

sciences.

Regarding the agreement with ULVAC, Managing Director Mike Gansser-Potts of OIPT said, "We have very high expectations for our collaboration with ULVAC, and are planning to provide our proven atomic-scale processing solutions to the power device and RF device markets in Japan."

Tetsuya Shimada, ULVAC Executive Officer and General Manager of the Advanced Electronics Equipment Division, commented, "This collaboration is extremely significant. OIPT's ALD/ALE process technology and expertise, which complement ULVAC's product portfolio, will enable us to provide complete solutions."

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**Oxford Instruments announces the sale in Japan of Atomfab® ALD high-volume manufacturing solution for GaN power device passivation**

— **ULVAC, Inc.**

In July 2019, ULVAC, Inc. began selling OIPT's Atomfab®, a plasma atomic layer deposition (ALD) high-volume manufacturing (HVM) solution for the GaN (gallium nitride) power device industry in Japan.

GaN devices are enabling the use of next-generation efficient power electronic devices in applications such as energy-saving home appliances, 5G networks, electric vehicles, and renewable energy conversion. Although GaN devices were previously efficient and demonstrated high performance, they faced manufacturing yield and scalability challenges that needed to be addressed.

For OIPT, one of the key challenges was to achieve consistently high-quality gate passivation, and Atomfab® delivered this solution with high throughput and low Cost of Ownership (CoO).

1. Performance: Excellent passivation and dielectric properties enable the demanding device performance critical for key applications.
2. Plasma: Remote plasma delivers a reproducible GaN interface. Atomfab® precisely controls the plasma to protect the underlying sensitive GaN substrate.
3. Pace: High throughput is delivered by a high deposition rate process on a high uptime HVM platform specifically developed for GaN power applications.

The significantly reduced cost per wafer that Atomfab® delivers is enabled by numerous technical



**ALD high-volume manufacturing solution Atomfab®**

**Children marvel at the experiments 46th Chigasaki Space Classroom**

— **ULVAC, Inc.**

On March 2, 2019, the 46th Chigasaki Space Classroom was held at the ULVAC Head Office/Plant.

Since the previous Space Classroom (in 2017) had so many applicants that participants had to be chosen by lottery, the number of children admitted was increased for the 2019 session.

Employees from the Research and Development Division and General Administration & Personnel Department acted as instructors. The children experienced seven kinds of vacuum experiments, including shooting a vacuum cannon and making aerated chocolate.

Although the Chigasaki Space Classroom was long (two hours including the vacuum experiments and factory tour), most of what the children saw and heard was new to them, and they all showed keen interest from start to finish.

We hope the Space Classroom will encourage the children who attended to become interested in

vacuum technology. ULVAC needs a future reserve army!

**Overview of the Chigasaki Space Classroom**

The Space Classroom, held regularly since 2008, is organized by the Chigasaki Chapter of the Young Astronauts Club of Japan, and is hosted by the Chigasaki City Board of Education. In general, professors from JAXA and members of the Science Circle at the University of Tokyo have been acting as instructors. Chikara Hayashi, the third president of ULVAC, was the first leader of the Chigasaki Chapter of the Young Astronauts Club of Japan. He helped establish the Chigasaki Space Classroom thanks to his friendships with astronauts and people at the National Space Development Agency of Japan. After retiring from ULVAC, he established the Hayashi Fund.



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innovations, including a patent-pending fast remote plasma source.

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**Portable suctioning system developed through industrial-academic-government collaboration for use in areas affected by natural disasters developed through industry-academia-government collaboration**

— **ULVAC KIKO, Inc.**



In March 2019, ULVAC KIKO, Inc. in cooperation with the University of Miyazaki Hospital, Emergency Medicine and Acute Critical Care Center (hereafter referred to as “University of Miyazaki Hospital”) developed a portable suctioning system that can be used following a natural disaster.

Under the Eastern Kyushu Medical Valley concept formulated in 2010 through industry-academia-government collaboration in the region, Miyazaki Prefecture had been working to develop medical equipment and services by identifying local corporations whose superior technologies could help meet medical needs at the University of Miyazaki Hospital. The portable suctioning system was created through these efforts.

Normally, in hospitals and medical clinics, wall suction is provided in order to suction mucus and blood during surgery. Suctioning begins when the adapter of the suction (bottle) is connected to the wall. However, the equipment can be damaged by disasters such as earthquakes, and power outages caused by disasters can render wall suction unusable. Therefore, the hospital’s medical staff asked for a portable suctioning system that could be connected to the adapter of the suction bottle even in such conditions.

When we consulted the medical-engineering liaison, we were referred to the University of Miyazaki Hospital. A case had been reported to the liaison regarding a medical facility in Kamaishi City, Iwate Prefecture in which the in-wall suctioning system had been damaged and made unusable during the Great East Japan Earthquake of March 11, 2011. This was how joint development of the system started.

Since the portable suctioning system we developed has the same insertion port as wall suctioning systems and is powered by a battery, connecting the adapter of the suction (bottle) provides a maximum of 90 minutes of continuous suction. The unit is

compact and highly portable, so it can be used not only following a disaster, but also at schools and a variety of facilities that are not equipped with in-wall suctioning systems. This portable system with the same type of insertion port as the in-wall suctioning systems is the first of its kind in Japan.

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**Ground-breaking ceremony for a new plant at ULVAC Coating Technology (HEFEI) Co., Ltd.**

— **ULVAC COATING CORPORATION**



**Ground-breaking ceremony for the new plant**



**Architectural illustration**

In May 2018, ULVAC COATING CORPORATION (Head Office: Chichibu, Saitama) established ULVAC Coating Technology (HEFEI) Co., Ltd. (hereafter referred to as “ULH”) in Hefei City (Anhui Province), which is the central base for FPDs in China. A ground-breaking ceremony for a new plant was held that September.

ULVAC COATING CORPORATION began in January 1979 by splitting off from ULVAC, Inc. for the purpose of developing and manufacturing mask blanks for semiconductor ICs. Beginning in the 2000s, the company also applied its proprietary mask blank technology to developing large mask blanks for FPDs. It currently commands a 50% share of the world market in that sector. In 2002, ULVAC COATING CORPORATION established ULCOAT TAIWAN, Inc., a fully-owned subsidiary in Tainan City, Taiwan. ULVAC is now contributing a steady supply of mask blanks on a global scale.

The recently established ULH location is intended to provide a local supply of large mask blanks for FPDs in China, and to contribute to FPD manufacturers through photomask manufacturers in China. The start of production is slated for spring 2020.

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- ULVAC TECHNO, Ltd.
- ULVAC KYUSHU CORPORATION
- ULVAC TOHOKU, Inc.
- ULVAC KIKO, Inc.
- ULVAC EQUIPMENT SALES, Inc.
- ULVAC CRYOGENICS INCORPORATED
- ULVAC-PHI, Inc.
- TIGOLD CORPORATION
- ULVAC COATING CORPORATION
- Nisshin Seigo Co., LTD
- ULVAC Human Relations, Ltd.
- SHINKU CERAMICS CO., LTD.
- FINE SURFACE TECHNOLOGY CO., LTD.
- REJ Co., Ltd.
- SHOWA SHINKU CO., LTD.

■ **China**

- ULVAC (China) Holding Co., Ltd.
- ULVAC (NINGBO) Co., Ltd.
- ULVAC (SUZHOU) CO. LTD.
- ULVAC Orient (Chengdu) Co., Ltd.
- ULVAC Automation Technology (Shanghai) Corporation
- ULVAC Tianma Electric (Jingjiang) Co., Ltd.
- ULVAC (Shenyang) Co., Ltd.
- ULVAC (Shanghai) Trading Co., Ltd.
- ULVAC Materials (Suzhou) CO., LTD
- ULVAC Opto-electronics Thin Film Technology (Shenzhen) Co., Ltd.
- ULVAC CRYOGENICS (NINGBO) INCORPORATED
- ULVAC NONFERROUS METALS (NINGBO) CO., LTD.
- ULVAC Research Center SUZHOU Co., Ltd.
- Hong Kong ULVAC Co., Ltd.
- ULVAC VACUUM EQUIPMENT (SHANGHAI) CO.,LTD.
- ULVAC Coating Technology (HEFEI) Co., Ltd.

■ **Taiwan**

- ULVAC TAIWAN INC.
- ULTRA CLEAN PRECISION TECHNOLOGIES CORP.
- ULCOAT TAIWAN, Inc.
- ULVAC AUTOMATION TAIWAN Inc.
- ULVAC SOFTWARE CREATIVE TECHNOLOGY, CO.,LTD.
- ULVAC Materials Taiwan, Inc.

■ **South Korea**

- ULVAC KOREA, Ltd.
- Ulvac Korea Precision, Ltd.
- Pure Surface Technology, Ltd.
- ULVAC CRYOGENICS KOREA INCORPORATED
- ULVAC Materials Korea, Ltd.
- UF TECH, Ltd.

■ **Southeast Asia**

- ULVAC SINGAPORE PTE LTD
- ULVAC MALAYSIA SDN. BHD.
- ULVAC (THAILAND) LTD.

■ **North America**

- ULVAC Technologies, Inc.
- Physical Electronics USA, Inc.

■ **Europe**

- ULVAC GmbH

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**VACUUM MAGAZINE:**  
<https://www.ulvac.co.jp/wiki/en/>

# Innovation Begins in a Vacuum

# ULVAC'S Vacuum Technology



We take for granted the tablet displays that we use everyday, but they would not work without the vacuum technologies supplied by ULVAC. The vacuum technologies that we have developed over the past 60 years are used in a wide range of areas, including semiconductors, electronic devices, flat-screen TVs, solar cells, automobiles, pharmaceuticals, and food products for Smart Society.

“The Ultimate in Vacuum Technology”

We will continue to push the envelope of vacuum technologies in step with innovations in related technologies.