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* Positions and departments are correct as of the time of the roundtable discussion.

Unlocking new possibilities through the "integration" of research and development

ULVAC is constructing a research and development structure that aims for sustainable value creation, from short to medium-term product development to developing seeds for the future. Furthermore, we have established overseas development sites, and are promoting research and development through global collaboration throughout ULVAC. On this occasion, the Managing Executive Officer supervising development, Choong-Ryul Paik, along with 4 researchers from the Research and Development Division, the Institute for Super Materials, the Institute of Semiconductor and Electronics Technologies, and the Future Technology Research Laboratory, gathered to share their thoughts about a variety of topics, including the future of ULVAC.

A diverse exchange hints at the answers

Moderator: Although it is easy to say research and development, research can actually take many different forms. What tasks do you engage in on a day-to-day basis?

Nagakubo: I work at the Future Technology Research Laboratory (FTRL). Our mission is to develop new materials and processes aimed at 10 or 20 years in the future. Our job is to conduct research and development with the aim of entering the fields of new materials, new energy, and the environment.

Gibo: In my case, my task is to create products that lead to securing profits in the short to medium-term. I am in charge of the development and launch of sputtering equipment for next-generation displays at the Institute for Super Materials (ISM). Compared to Mr. Nagakubo's field of basic research, my position is more involved with manufacturing and specifically responding to the demands of customers.

Lee: The Institute of Semiconductor and Electronics Technologies (ISET) is also involved with product development. I have come here on secondment from ULVAC KOREA, Ltd., and have been involved with the development of the CVD*1 and ALD*2 processes, which are

important semiconductor film deposition technologies.

Oohashi: I work at the Research and Development Division (R&D), and I am involved with analysis, which is slightly different from what the rest of you do. My role is to respond to the range of requests for analysis directed to us by other departments. Although my involvement is indirect, I am involved in a wide range of products and technologies.

Gibo: ISM sends you a lot of requests for analysis, doesn't it? We communicate regularly to consult or receive proposals for methods of analysis.

Oohashi: We also participate in development meetings. We not only analyze what is in front of us, but we also consider it important to collect information concerning what is currently being developed. Sometimes it is difficult for us to participate due to the high number of requests for analysis, but we would like to remain close, in order to be part of a unified ULVAC team.

Paik: I also came from ISM, so I have a lot of memories of this. Once we had received the results of an analysis that we had requested, the most important thing was to reflect on whether the results were as we expected, and if they weren't, work out exactly how they differed. When I received an analysis report, I would often be introduced to materials that I didn't know about, so I think that interaction with the people at the Analysis Center is a valuable opportunity to exchange useful information.

Lee: That's very true. At one point, when an experiment did not go as planned, I consulted with the people from the Analysis Center, and they provided advice from a completely unexpected perspective, which allowed me to take the first step toward solving the problem. It taught me that when it comes to research and development, we mustn't get caught up in what is directly in front of us, but rather, it is important to exchange opinions with a variety of people.

Gibo: I also had an experience in which I had unexpected results, and I was unable to discover the cause, no matter how hard I tried, but analysis helped me to find a clear answer. Breaking your thought patterns, such as by listening to the opinions of people from different fields, really helps you make discoveries. Sometimes mistakes and

misunderstandings can lead to new discoveries, so I would like to embrace a range of challenges.

Oohashi: Apart from that, once you have mulled over the problem as thoroughly as you can, it can be good to switch your brain over to something completely different. Sometimes you can make use of your realizations in another task.



Research and Development Division **Tomomi Oohashi**

Nagakubo: When I am stuck, I value returning to basic principles of Physics. In the case of FTRL, it is not uncommon for us to conduct research that has never been engaged in at ULVAC, so there are times when our experience is insufficient to solve the problems that we face. In those instances, we are instructed by the head of the laboratory to consider the results of the work we have performed in terms of what they mean from the perspective of physics, and we do our best to share and discuss the data.

Paik: Although we are all involved with research and development, there are many different fields of research and types of researchers. Mr. Nagakubo is the type of researcher who examines physical concepts. He thinks about things from the perspective of principles, while clearly stating the processes and reasoning that he uses. On the other hand, chemists and engineers do things slightly differently. They think about how to achieve the required results, particularly in the development of materials. There are some things that they will be unable to explain using theory and empirical assumptions, for example. Also, mankind evolved from hunter-gatherers to an agricultural people, and this is also indicative of types of researcher. In recent times, agricultural-type researchers, where success is built by following processes, have been increasing in number. However, we also need hunter-type, who judge whether there is anything of value to be garnered through their experience and intuition, in research and development. The ideal organization is one that gathers a range of different types and leverages their strengths to produce results.

*1 CVD = Chemical Vapor Deposition: A type of deposition technology that utilizes chemical reactions.

*2 ALD = Atomic Layer Deposition: A type of deposition technology that deposits a thin film at an atomic level.



Institute of Semiconductor and Electronics Technologies **Keon-Chang Lee**

Actively promote contact with customers, and contribute from their perspective

Moderator: I suppose you gain knowledge from experience, too. Is there anything else you are working toward?

Paik: The thing that teaches us the most is our relationship with our customers. We gain a lot by going to our customers and directly finding out what kind of research they are conducting and what they require from us.

Oohashi: I sometimes receive urgent requests for analysis from the equipment manager regarding problems that have occurred at our customers' sites. If the person in charge of the equipment needs help, that means a customer also needs help. I feel a great sense of relief when we are able to quickly conduct analyses and convey the results, which lead to a discovery of the cause of the problems. Analysis for the evaluation of the performance of equipment is necessary to achieve customer satisfaction. Although we do not deal with customers directly, I am proud that we are able to make a contribution to them.

Lee: As a process developer, there are many ways in which I can make contributions to customers. For example, the other day I conducted an evaluation of the membrane characteristics of a metal film that uses a new material. The results showed that the membrane characteristics were better than those of the product being developed by the customer, which led to the customer requesting that we continue our development. I hope that I am able to actively participate in the solution of issues that customers struggle with, from the perspective of a researcher, so that we are able to solve them together, allowing both companies to grow.

Paik: It was actually customers that led me to become a researcher. The needs of the customer are the seeds of our business. I hope that all of you youngsters have as much contact with customers as possible and maintain a high level of motivation for your research and development work.



Managing Executive Officer Supervisor of Development **Choong-Ryul Paik**

The challenge to become the best in the world and our hopes after integration

Moderator: Please tell us about your opinions concerning the outlook going forward and how you envision ULVAC in the future.

Oohashi: First, it is necessary to deliver high-value products and technologies to the world in the current market. However, it is also essential to embrace new challenges. Research and development can cover a wide range of fields, and they should not be thought of as a single entity. It is important to undertake research and development in a balanced fashion, even though that is hard to sum up in a single sound bite.



Future Technology Research Laboratory **Junki Nagakubo**

Nagakubo: I would like to be involved with manufacturing equipment for key parts that are used in growing markets, such as robotics and artificial intelligence. It would be ideal to secure our position at the top of our niche, and for ULVAC to be a company that top researchers think of as a desirable place to work.

Gibo: I believe that, at present, ULVAC is not fully utilizing its research and development and its technological capabilities. I strongly feel the need to achieve integration, which has been a topic for the whole company, such as by making sure that we are all on the same page and increasing ties between departments.

In addition, I think that there are many opportunities for ULVAC's businesses to be involved with producing world-leading products. In order to produce cutting-edge technology and products, both equipment and materials are indispensable. It is my dream to be able to proudly declare that ULVAC is involved with the production of the world's best products because of its technology.

Paik: I would like to strengthen the solidarity within ULVAC by continually embracing new challenges and fostering bonds that go beyond individual organizations. The fact that we have research and development centers around the world is one of ULVAC's unique strengths. ULVAC has research and development centers in four

overseas locations – Korea, America, Taiwan, and China. These are all areas in which our customers are expanding their businesses. We must effectively leverage these research and development centers in order to be able to respond swiftly and appropriately to the varied needs of customers around the world. As Mr. Gibo said, it is important for us to come together as a company and proceed with unification to stay ahead of the pack in the future. Based on our Open R&D strategy, we hope to ensure a diverse research and development structure.

Shifting to a global focus and pursuing dynamic research and development

Moderator: Finally, please give us your messages for the young researchers who will bear the expectations of the next generation.

Lee: The benefit of working at ULVAC is the many opportunities to work alongside people from countries all around the world. I am currently in Japan on secondment, and there are many people within my department with overseas work experience. Improving individuals' skills leads to the development of the company, and also improves personal satisfaction. I hope to further improve my ability to understand other cultures, view things from the perspectives of others, and empathize with others.

Oohashi: ULVAC provides an environment in which we can freely challenge ourselves, irrespective of our gender or academic record. In other words, it is important to have the ability to think and act for yourself. Without doubt, you will develop specialist knowledge and skills through your day-to-day work. I would like us to be a group of people who actively challenge ourselves.



Institute for Super Materials **Manabu Gibo**

Gibo: Research and development is a job that involves creating something new. Naturally you need the will to challenge yourself, but you also need to thoroughly conduct risk analysis and other procedures. If you are able to do both of these things, you will be able to contribute to a broad range of areas at ULVAC. Also, when conducting research and development, trivial things often lead to new doors being unlocked, so I also value a sense of curiosity and fun.

Nagakubo: ULVAC is a company where people are able to challenge themselves if they have the vision to contribute to the world through research and development or to make certain products. Also I aim to produce results from research and development that lead the younger generation to have dreams for the future, without forgetting to apply myself diligently.

Moderator: Thank you very much for joining us today.

Moderator
Senior Manager, Corporate Communications & IR Team,
Management Planning Division, ULVAC, Inc.
Noriaki Suzuki

Message

After the Roundtable Discussion

Choong-Ryul Paik

Since fiscal 2015, we have promoted a policy of integrating development, and merging, selecting and concentrating technology at an even higher level, under the slogan of "Open R&D." Going forward, we will expand and deepen our integration by strengthening solidarity throughout the ULVAC Group, such as by introducing management systems to further improve the speed and efficiency of development, integrating the development, sales, and manufacturing departments, and discovering development items that will form the pillars of ULVAC's business in the future. At this roundtable discussion, I felt everyone's strong enthusiasm for research and development. In order to succeed at research and development, selecting the right theme is

extremely important, and in order to do that, each department must produce many proposals. Going forward, I would like to increase the opportunities to engage in discussion with young researchers at the company. Also, it is my hope that you will all become global citizens. At present, overseas orders and sales account for more than half of ULVAC's total orders and sales. In 10 years' time, the ratio of overseas orders and sales may jump to 70% or 80%. I would like you to experience foreign countries while you are still young, and apply yourself diligently to your research, working closely with customers and other researchers from around the world.

I expect great things from our young researchers.