



Preface

Special issue on Devices and Materials for Human Centric Innovation

A handwritten signature in black ink that reads "Ei Yano".

Ei Yano
Member of the Board
Fujitsu Laboratories Ltd.

Fujitsu aims to realize a safer, affluent, and sustainable society by applying its Human Centric Innovation. It is the overwhelming evolution of digital technology such as the Internet of Things (IoT) and artificial intelligence (AI) that is supporting this. More than 50 billion items will be connected in a network in 2020, and the vast data collected from these items will be processed by AI. This will create new knowledge, and be a strong tool to aid in human judgment. Fujitsu aims to evolve these digital technologies with various value chains of techniques, ranging from devices and materials to system solutions, and is pushing forward with technology development.

The main business area of the Fujitsu Group has been changing from products to services. But, as a way to differentiate our services from those of competitors, device and materials technology is still important, as a basic technology that is also related to intellectual property and that can help us judge which new technologies we should use. This special issue introduces the leading-edge technologies of devices and materials that are the core of our technology value chain.

It is thought that two important roles are demanded of device and materials technology, which support the foundation of IoT and AI. One is the advancement of IoT front devices such as sensors which collect various types of data from the real world and send them to the virtual world. And the other is the continuous evolution of Information and communications technology (ICT) infrastructure such as networks or computers processing vast amounts of data. As for sensors, the devices and materials they are made of decide most of their performance. For example, some new high-speed, high-power devices use a high-performance radar system, and it helps enhance safety for people, such as by preventing car accidents or improving national security. New materials give new functions to sensors. They enable the digitization of all data which surrounds people, and sometimes serve to replace the five senses of humans including the sense of taste and smell.

In ICT infrastructure, there has been an increase in the quantity of data and a rapid surge in energy consumption and these have become an urgent problem. Highly efficient devices which can process optical or high-frequency radio signals enable fast and large-capacity communication at a low power consumption. New packaging technology can lead to smaller, faster, and more energy-efficient systems, even if the system is built from a combination of standard

devices, and it is becoming more important as a technique to help enhance the performance of LSIs to overcome the limit to miniaturization of chips. These technologies are supporting evolution in many areas, ranging from the whole ICT infrastructure, made up data centers and the cloud, to products such as networks and computers. Against this background, we have been working on research and development of advanced devices and materials. In this special issue, we introduce compound semiconductor device and circuit technologies utilizing materials such as gallium nitride (GaN). They are aiming to achieve high-performance sensors and high-speed communication. We also showcase a 2.5D/3D packaging technology to realize the ultimate high-density system module for next-generation computers and network apparatus with high performance and low energy consumption. This special issue also reports on advanced technologies such as nanocarbon materials that can overcome the limits of silicon. I hope this special issue helps to give you a better understanding of how these fundamental technologies are supporting part of the digital technology of the Fujitsu Group.