Research Centers under the BEANS Project (Part II)

1. Life BEANS Center Kyushu (Kyushu University)

The Life BEANS Center Kyushu is involved in the development of process technologies for integrating bio and organic materials. Organic semiconductor has been recognized as a key for developing the next generation of electronics. These days it is expected to develop optic and electronic devices with added value of flexibility and a large surface area with high quality that are difficult to achieve with conventional inorganic semiconductors. Our research team is developing organic semiconductor fabrication processes that provide an inexpensive solution to large-area nanostructure control, with the goal of expanding into optoelectric and thermoelectric energy conversion devices in the future.

The Life BEANS Center Kyushu collaborates with the Kyushu Institute of Technology, Lintec Corporation, and Panasonic Electric Works and operates in close coordination with research teams at the University of Tokyo and the National Institute of Advanced Industrial Science and Technology (AIST). We are striving to integrate such dissimilar fields as electronics, chemistry, and mechanics and are developing process technologies for integrating new bio-organic materials. A distinction of our Center is the large number of joint research projects that we are conducting with other centers in the BEANS Project, including a joint project with the 3D BEANS Center on ultra low-damage dry etching using a neutral beam, and a supercritical deposition technology. We have accelerated research on the neutral beam etching technology after installing equipment for etching organic film at the Life BEANS Center Kyushu. Supercritical deposition is also being studied to develop a technique for filling organic nanostructures fabricated at our Center. At the Life BEANS Center Kyushu, we are making steady progress toward the BEANS objective of hetero function integration which we hope will lead to the development of innovative devices.

2. 3D BEANS Center Shiga (Ritsumeikan University)

The 3D BEANS Center Shiga is involved in R&D on fabricating 3D nanostructures for space applications. Unlike the other research centers in the BEANS Project, 3D BEANS Center Shiga conducts R&D with the goal of applying micro/nanomachining to space applications. Based at the Biwako-Kusatsu Campus of Ritsumeikan University, Researchers from Ritsumeikan University, the Institute for Unmanned Space Experiment Free Flyer Foundation (USEF), the Japan Resources Observation System and Space Utilization Organization (JAROS), and Mitsubishi Electric Corporation conduct the research. The researches at the Center involve developing a technology for simulating subwavelength optical structures, developing micro/nanomachining technologies through anodic oxidation, developing optical and structural evaluation techniques for filters with 3D nanostructures designed for space applications, and studying an evaluation index on the applicability of 3D nanostructures for space applications.

3. Macro BEANS Center (AIST)

Based at AIST Tsukuba East, the Macro BEANS Center is engaged in the development of micro/nanostructure large-area continuous fabrication processes through collaboration among researchers in an AIST-Macro BEANS collaborative research group and researchers from Toshiba Machine Co.,LTD., The Furukawa Electric Co., LTD. and Mitsubishi Electric Corporation, and BEANS Laboratory.

We are working to produce meter-scale large-area energy harvesting devices for use in the fields of environment and energy and health and medical care at considerably lower cost and with higher performance using micro/nanostructures. We are also looking to develop new flexible sheet-like devices that can be mounted on a 3D free-form surface for use as wearable power generators, jackets designed for safety and security, and sheet-like health monitoring devices. However, continuing to employ fabrication techniques based on conventional semiconductor equipment to manufacture such devices has exposed problems such as limitations in the size of the vacuum process equipment and the surface area of the substrates. In order to reduce costs and increase performance of conventional meter-scale large-area devices, we must develop new fabrication process which deposits high-quality functional films having micro/nanostructures on meter-scale substrates without using vacuum process equipment. We must also develop a new fabrication technology that realizes meter-scale flexible sheet-type devices utilizing micromachining and weaving integration of fiber substrates instead of micromachining of large substrates.

To meet these needs, the Macro BEANS Center is conducting R&D on innovative next-generation non-vacuum processes based on techniques for coating functional materials, such as nano particles, that integrate a technique for activating nano functional materials through local control of ambient gas and temperature, and a technique for controlling the density and arrangement of nano functional materials. With these non-vacuum processes, we hope to develop a technology for the rapid and direct formation of high-quality functional films with micro/nanostructures on meter-scale large-area substrates. We are also conducting R&D on a technology for the continuous rapid formation of high-quality functional films on fiber substrates through a non-vacuum process, and a technology for increasing the functionality and surface area of this fiber substrate through a new weaving/integration process.

Researchers at the Macro BEANS Center