Nagoya Nano-Technology Manufacturing Cluster

Aichi/Nagoya (Fiscal Year 2003-2007)

Life Sciences IT Environment Nanotech/Materials

The Aichi/Nagoya region is working to establish new businesses and industries by using nanotechnologies to revolutionize its manufacturing expertise

Core Organization Aichi Science & Technology Foundation

Participating Research Organizations (Bold: Core Research Organization)

Industry…Toyota Central R&D Labs., Inc., SINANEN ZEOMIC CO., LTD., Pokka Corporation, Taiyo Kagaku Co., Ltd., Moritex Corporation, BEL Japan, Inc., OSP Inc., DENSO CORPORATION, Osaka Vacuum, Ltd., UNISOKU Co., Ltd., TAIYO NIPPON SANSO CORPORATION, Dowa Electronics Materials Co., Ltd., NGK INSULATORS, LTD., Oki Electric Industry Co., Ltd., Shindengen Electric Manufacturing Co., Ltd., New Japan Radio Co., Ltd., ULVAC CORPORATE CENTER, Hitachi Metals, Ltd., Tanaka Kikinzoku Kogyo K.K., n-Factory Co., Ltd., Advantec Toyo Kaisha, Ltd., Sanko ULVAC Co., Ltd., INAX Corporation, YUKEN INDUSTRY CO., LTD., TAKEDA PRINTING CO., LTD., KATAGIRI ENGINEERING CO., LTD., COM Electronics Development Co., Ltd., NU EcoEngineering Co., Ltd., AISIN SEIKI CO., LTD., Mizuno Corporation, ULVAC, Inc., MEIJO NANO CARBON Co., Ltd., etc.

Academia…**Nagoya University, Nagoya Institute of Technology,** Meijo University, Wakayama University

Government…National Institute of Advanced Industrial Science and Technology, Aichi Industrial Technology Institute, Nagoya Municipal Industrial Research Institute

Project Overview

We promoted a center of environmentally-friendly nanomanufacturing by exploiting the extensive industry expertise in this region which supports the manufacturing industries in Japan. As an example of our R&D, we have developed autonomic nanomanufacturing devices which can simultaneously achieve higher added-value for manufacturing and reduce the environmental load.

For this purpose, we utilized unique technology seeds of Nagoya University and the Nagoya Institute of Technology, etc. and have constructed the “Nagoya model” for technology transfer from universities to industries.

In order to realize sustainable development as a manufacturing center, we are also implementing wide-ranging regional projects. These include human resource development through means such as recruiting young researchers and conducting MOT training, providing support for university-initiated venture companies and small- and medium-sized enterprises, and collaborating with the Industrial Cluster Project.

Boosted by these projects, significant infrastructure advancements have been made thanks to cooperation among industry, universities, and government. Examples include the Plasma Nanotechnology Research Center and the Nanostructures Research Laboratory.

Main Results

1. Implemented programs targeting the creation of a regional cluster
   - The Plasma Center for Industrial Applications was established and went on line, aiming to both spread R&D results within this region and commercialize related technologies.
   - Four university-initiated venture companies were established, and two new offices in the region were created. Theme-based Workshops were launched, and sustainable spreading was made to expand the use of research results in the region.
   - Six projects were selected by the Ministry of Economy, Trade and Industry as Regional Innovation Creation R&D Programs and other projects, and progress was made toward the start of business operations.

Autonomic Nano-Etching Device

2. Succeeded in developing an extremely compact sensor for direct measurement of the radicals in plasma, which contributes directly to the etching of semiconductors

   Previously radicals could only be measured using bulky spectrophotometer equipment. However, we have succeeded in developing a new light source which allows measurement to be performed by a compact sensor probe only a few millimeters in diameter. Using this sensor, we have developed autonomic nano-etching devices that autonomically control the production conditions and perform hyperfine nano-machining under optimal conditions at all times. A venture company under this Initiative has succeeded in commercializing this device. This technology is expected to revolutionize semiconductor dry etching devices, where the yield is dropping as increasingly hyperfine structures are required.

Autonomic SAM (Self-Assembled Monolayer) Manufacturing Equipment

3. Succeeded in developing an autonomic SAM manufacturing equipment which can be applied in wide-ranging fields

   * SAM: Self-Assembled Monolayer

   SAM coatings can enable various functions, such as water-repellant or hydrophilic properties, to material surfaces. In cooperation with a venture company under this Initiative, we have successfully developed autonomic SAM manufacturing equipment which can autonomously create SAM coatings via a low-temperature and low environmental load process under given optimal conditions. We are now working to develop ultra water-repellent nano-paper with both water repellant and water resistant properties, and aim to apply this technology to resist materials, DNA and protein chips, and for other purposes.

4-inch AlGaN/GaN HEMT Substrate

4. Successful development of technology for manufacturing the GaN semiconductor epitaxial-wafers which enable high-efficiency power electronics devices.

   We have developed a technology for growing GaN thin film crystals with minimal defects on a 4-inch silicon wafer. The enterprise to which this technology was transferred has established a new company and has begun supplying samples to the market. This technology is expected to enhance the efficiency of electrical appliances, IT devices, and electric automobiles.