



Aichi/Nagoya

The Aichi/Nagoya area aims to establish new industries based on nano-technologies and accumulation of manufacturing know-how.

Cluster Vision

For 30 straight years, Aichi Prefecture has led Japan in manufactured-product shipments, and it has accumulated advanced fabrication and materials technologies that support the manufacturing infrastructure of Japan. Making the most of these technologies, the local industry, academia, and government in the Aichi/Nagoya area cooperate in research and development of autonomic nano-production devices that simultaneously achieve the twin targets of "high added value" and "reduced impact on the environment." The nano-products manufactured by these devices and equipment are used in a wide range of fields such as the machining, automotive, aircraft, chemical, electronics, medical, and bio industries. The district thus aims to form a "Nano-Technology Manufacturing Cluster" that will become a global center for environmentally conscious manufacturing.

Project Overview

Nagoya University originally developed plasma diagnosis, which measures atomic and molecular densities inside a reaction space. Based on this unique technology, we aim to research and develop smart sensors for measurement and SAM nano-patterning. Another goal is the development of autonomic nano-production devices that can perform autonomous optimal nano-fabrication, and this will be achieved by combining a variety of highly functional materials developed at Nagoya Institute of Technology and Meijo University. With these devices, we will be able to perform ultra-micro processing on a nano-order scale as well as industrial-scale manufacturing of ultra-sensitive sensors and highly functional catalysts. As a ripple effect, we can greatly reduce consumption of energy and raw materials and build production systems which are gentle on the environment.

These results will be marketed, and scientific technology coordinators will coordinate the transfer of technology to enterprises and the creation of new venture business companies in order to develop new products and new industries.

- Development of nano-process control technology using smart sensors and use of this technology in autonomic nano-production devices
- Development of SAM nano-patterning technology and use of this technology in autonomic nano-production devices
- Development of nano-cluster/interface-control materials and use of these materials in ultra-high sensitivity sensors
- Development of organic/inorganic hybrid nano-materials and use of these materials in nano-catalysts
- SAM (self-assembled monolayer): Monomolecular (monolayer) film in which atoms and molecules naturally assemble to form a specific structure without human intervention

Project Director Osamu Takenaka



Osamu Takenaka is a former general manager of the production engineering R&D Department at DENSO CORPORATION

Sense of Crisis is a Point of Departure

Why was the Aichi/Nagoya area, despite its being Japan's number one region in manufactured-product shipments, designated as merely a Cluster Trial Area? This was my starting question when I was appointed Project Director, with the mission of strengthening our Cluster Headquarters structure. From my experiences in private business, I have learned to thoroughly research a problem while constantly repeating the question: "Why? Why? Why?" This process can be boiled down to the maxim: "Learn from your failures!" So, the first thing I did after my appointment was to meet face-to-face with the Prefectural Governor and University Presidents, and ask them to express their sentiments (and consciousness) regarding our hitherto-achieved results. All were shocked by our current state, and we jointly resolved to work towards achieving a higher Cluster status at the next official designation.

Next, to stimulate local initiative and self-determination, I worked chiefly with local governments to establish a basic concept for the Aichi/Nagoya Cluster. Thereafter, with the aim of restructuring research themes (and seeds) towards that basic concept, we held numerous meetings with concerned parties, marking over 40 hours of heated discussions. The result: the settlement on themes that we would uniformly pursue. I am convinced that, by taking a leadership role as Project Director with the key support of the President and Chief Scientist of Cluster Headquarters, our frank discussions with research leaders led to the clarification of our development concept: "The development of practical 'autonomic nano-production devices' for performing nano-fabrication and nano-product manufacturing."

It is essential that all of us involved—from the heads of industry, academia and government, to the persons in charge of the day-to-day work—share a common critical mindset, and work as a team to realize our basic concept. It is my personal responsibility as Project Director to smoothly coordinate good plans (strategies, research, and enterprise creation) and good people to achieve good results.

Thanks to the concentration of knowledge and industry within our area, we successfully established four new venture business companies during the past four years. In the future, these project results will act as the "primer", and we will continue our efforts to become a global hub of environmentally-friendly manufacturing, as Japan's No. 1 manufacturing zone.

Cluster Headquarters

President.....Tsuneo Ishimaru (Director of Aichi Branch, Japan Institute of Invention and Innovation)

Project Director.....Osamu Takenaka

Chief Scientist.....Susumu Maruse(Prof. Emeritus of Nagoya Univ.)

SCIENCE and Technology Coordinator... Shoji Noda, Motoo Nonomura, Osamu Oda

Core Organization

Aichi Science and Technology Foundation

Participating Research Organizations (Bold: Core Research Organization)

Industry...Toyota Central R&D Labs., Inc., SHINANEN 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, Dow 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-Factor 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., AISHIN SEIKI CO., LTD., Mizuno Corporation, ULVAC, Inc., Meijo Nano Carbon Co., Ltd.

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

Main Results

- Succeeded in the development of an extremely compact sensor that can directly measure radicals in the plasma that contribute to the etching of semiconductors. An extremely compact radical sensor has successfully been developed. With this device, radicals (hydrogen, nitrogen, and oxygen atoms) in plasma will be measured in real time and plasma processes like etching can be optimized by controlling the radical concentration to the given values. This device is a key component of an Autonomic Nano-Etching Device that will always result in fine etching on the order of 65 nm.
- Establishment of four venture companies and two new offices by the enterprise. Four new companies were established: NU EcoEngineering Co., Ltd., developer of the aforementioned sensors; NU system corp., developer of nano-spectrometer technology; n-Factor Co., Ltd., developer of highly water repellent organic molecular film coating equipment; and Meijo Nano Carbon Co., Ltd., manufacturer of highly crystalline and high-quality carbon nano-tubes through a highly efficient process. Furthermore, 2 of the participating research institutes (the companies BEL Japan, Inc. and KATAGIRI ENGINEERING CO., LTD.) have established new offices in the region in order to commercialize the results of the Knowledge Cluster Initiative.



Compact radical sensor (integrated VUV light source and VUV spectrophotometer)



Large-area and high-rate SAM coating device



Nano-thin film structure analyzer

