



- Japan Technology Group is currently focusing on the following areas for its technology transfer activity:

BIOLOGICAL SCIENCE:

- I. Hand Incubator**
 - Wound healing/ Closure Device (burns, poisoning, wound/ulcer healing)
 - Pain Management (Musculoskeletal, Chronic, Post-operative pain)
 - Drug Delivery topically or transdermally in controlled and continuous fashion

Hand Incubator device can release the muscle strain and pressure, while completely alleviating the pain, in only 10 minutes.
It can be used as a post-surgical pain relieving device, or during the repetitive motion work to prevent or eliminate the muscle strain.
- II. Glutamate Decarboxylase (GAD) Mutant Improved Detection System for Diagnosis of Type 1 Insulin-Dependent Diabetes Mellitus (IDDM)**

This invention is a GAD65 mutant having a retained antigenicity to an autoantibody specific to pancreatic islet beta-cells and having thermal stability which is useful for early diagnosis of insulin-dependent diabetes mellitus.
- III. Hairless Transgenic Nonhuman Animal**

The transgenic animal intends to be used in developing a therapy for dermatitis such as human atopic dermatitis and drug discovery. More specifically, a transgenic nonhuman animal into which a recombinant DNA containing a heparin-binding EGF gene and a type 2 keratin gene promoter capable of regulating the expression of the above-described gene has been transferred.
- IV. Bone Substitute material for medical use and method for producing the same**

Bone Substitute material for medical use, which satisfies all the requirements of no histotoxicity, osteoconductivity, bone replacement capability, and mechanical strength necessary for a bone reconstruction operation. The bone substitute material for medical use is predominantly composed of carbonate apatite by contacting a block of calcium compound with a phosphate-containing solution, wherein the calcium compound block contains substantially no powders, and at least one of said calcium compound block and said phosphate solution contains a carbonate group, without any sintering. The block of calcium compound is preferably one prepared using an artificially synthesized calcium compound, most preferably a foamed calcium compound.
- V. Drug for the Gum disease**

Peptide derivatives and their pharmaceutically acceptable salts, and processes for preparation. The formula of one of the derivatives contain R1-hydrogen or an amino protecting group; R2 hydroxyl or lower alkoxy; one of the R3 and R4 is the side chain (R group) of lysine the amino group of which may be protected with a protecting group and the other of R3 and R4 is the side chain (R group) of arginine the guanidine group of which may be protected with a protecting group; and R5 and R6 may be the same or different and are hydrogen, lower alkyl or aralkyl. Unlike previous compounds, these peptide derivatives have potent inhibitory activity against both proteolytic enzymes produced by bacterium *P. gingivalis*, specifically, Lys-gingipain and Arg-gingipain, which are involved in the onset of periodontal disease and periodontal tissue destruction. Thus, the novel compounds can be useful as a periodontal preventative of therapeutic agent.
- VI. Enhancer of anti-cancer drug, TNIII A2 as 22-mer peptide**

22-mer peptide derived from tenascin-C, abbreviated as TNIII A2 has been demonstrated to be capable of inducing programmed cell deaths in malignant tumor cells (mouse osteosarcoma, LM8), after demonstrated that TNIII A2 has the ability to induce the functional activation of

β 1-subfamily of integrins.

Brief description of our technology is that TNIIIA2 could potentiate the adhesion of LM8 cells to the fibronectin substrate by activating β 1-integrins strongly. LM8 cells were then shown to undergo apoptotic deaths when kept adherent on the FN substrate in the presence of TNIIIA2. When LM8 cells were incubated with an anti-cancer agent, Doxorubicine (DOX), in the presence of TNIIIA2, the induction of the cell deaths was accelerated, indicating that TNIIIA2 increased the cell chemosensitivity to DOX. TNIIIA2 increased the DOX accumulation in the LM8 cells. Since TNIIIA2mut, an inactive control peptide of TNIIIA2, has no potential to accumulate DOX in the LM8 cells, it is conceivable that increase in the chemosensitivity of the LM8 cells to DOX induced by TNIIIA2 is responsible for potentiated adhesion of cells on the fibronectin through β 1-integrin activation. TNIIIA2 is expected to contribute to increase the antitumor effects of anti-cancer drugs, e.g. DOX.

VII. New dihydronaphthalene compounds and proteasome inhibitors containing them as active ingredients

New dihydronaphthalene compounds that can be synthesized efficiently and proteasome inhibitors containing such compounds as active ingredients:

Usual lasofoxifene and nafoxidine analogues are poorly productive due to their geometrical and/or position isomers and they have no proteasome inhibitory effects. The traditional proteasome inhibitors also have problems in productivity because it takes many steps to synthesize them. The new dihydronaphthalene compounds in this invention are valuable as proteasome inhibitors, and can be synthesized with no isomers easily and effectively. Thus these compounds are expected to be valuable as anticancer agents, as therapeutic agents for inflammation or immunological diseases, and in the development of new pharmaceuticals for neurodegenerative diseases, e.g. Alzheimer's disease and Parkinson's disease. Thus, valuable for cancer, neurodegenerative diseases and immunological diseases.

VIII. Nanoparticles for Inhalation Drug Delivery

To overcome the disadvantages both of microparticles and nanoparticles for inhalation, the nanocomposite particles can act as drug carriers targeting lungs. The nanocomposite particles having sizes about 2.5 μ m composed of sugar and drug-loaded PLGA nanoparticles can reach deep in the lungs, and they are decomposed into drug-loaded PLGA nanoparticles in the alveoli. Sugar was used as a binder of PLGA nanoparticles to be nanocomposite particles and is soluble in alveolar lining fluid. The primary nanoparticles containing bioactive materials prepared by using a probe sonicator, can be sprayed dry with carrier materials, such as trehalose and lactose. The effects of inlet temperature of spray dryer were studied between 60 and 120 $^{\circ}$ C and the kind of sugars upon properties of nanocomposite particles. When the inlet temperatures were 80 and 90 $^{\circ}$ C, nanocomposite particles with average diameters of about 2.5 μ m are obtained and they are decomposed into primary nanoparticles in water, in both sugars are used as a binder. But, those prepared above 100 $^{\circ}$ C are not decomposed into nanoparticles in water, while the average diameter was almost 2.5 μ m. On the other hand, nanocomposite particles prepared at lower inlet temperatures have larger sizes but better redispersion efficiency in water. By the measurements of aerodynamic diameters of the nanocomposite particles prepared with trehalose at 70, 80, and 90 $^{\circ}$ C, it was shown that the particles prepared at 80 $^{\circ}$ C have the highest fine particle fraction (FPF) value and the particles are suitable for pulmonary delivery of bioactive materials deep in the lungs. Meanwhile the case with lactose, the particles prepared at 90 $^{\circ}$ C have near the best FPF value but they have many particles larger than 11 μ m.

IX. Three cell lines for the curative medicine screening of chronic allergy diseases

The cell lines, No N62.5 cells, R cells, and RCCM cells are the same basophiles or mast cells which are Fc ϵ RI α positive, Fc γ receptor II/III positive and c-kit positive, not cancer cells.

The conditions of growth of three cells are different. No N62.5 cells needs a full-quantity growth factor, R cell need a small-quantity growth factor and RCCM cell need not a growth factor. This three cell lines are useful for the screening of curative chronic allergy diseases medicine.

X. Cell Or Tissue-Culturing Carrier, And Culturing Method

Invention: A support for cell/tissue culture and a method of cell/tissue culture whereby a target tissue or organ.

This invention has many advantages including:

- Artificial carrier
- in vitro 3D culturing carrier
- sol-gel transition by temperature
- Easy cell collection
- Suppressing growth of fibroblasts

Tech Classification: Biotech, Tissue Engineering, Secondary Screenings

Patent Status: Patent pending JP/US/EP/CA

Technology Level: Currently Being Produced, Tooled or Fully Engineered

Licensing : Available with non exclusive

Cooperative Research /Development Opportunities: Available with the inventors

XI. Dynamic Bond-Order Molecular Dynamics Simulator

In the field of nanotechnology, a new simulation method is required to describe atomistic properties of various materials. A nanometer-scale structure is a quite large system comprising hundreds of thousands of atoms. A practical approach to realize such a large-scale simulation is employing the classical molecular dynamics (MD) which assumes a simplified inter-atomic force-field. However, most of the conventional inter-atomic force-fields are limited for unary or binary compound systems; otherwise a covalent-bond network is fixed during the simulation to describe a multi-element compound material like a protein molecule.

Dynamic bond-order MD is the new method which allows changes in the covalent-bond network even in multi-element compound materials. This feature drastically simplifies the parameter fitting procedure, so that it enables you to design a variety of force-fields even for compound systems consisting of many types of elements.

XII. High Aspect Ratio Nano-scale CFx Structures Fabricated by Deep-RIE

3-dimensional high aspect ratio (>500) nano-scale CFx (fluorocarbon) "tube" and "test-tube" arrays were realized using Deep Reactive Ion Etching (RIE). Sidewall CFx nano structures formed by Deep RIE passivation process. The film thickness of CFx was controlled from 200 nm to 500 nm, and the height more than 100 μ m was available.

We applied the DRIE process to a novel fabrication process of 3-dimensional nano-scale fluorocarbon structures. High aspect ratio fluorocarbon tube or test-tube arrays were fabricated using the excessive CFx passivation structure followed by Si etching in a microchannel. This method enables to fabricate variety of 3-dimensional fluorocarbon structures with low surface energy, excellent chemical resistance, and prevention from protein adsorption and thermal stability. This fluorocarbon tube array and test-tube array are useful tool for chemical reactors and cell bioreactors.

XIII. Individual Single Cell Manipulation with Micro Chamber Array

Micro chamber array system efficient for the single cell manipulation was fabricated. The sequential capture, release and rupture of a single cell were achieved.

Just controlling the flow rate and ratio of two channels independently, you can control the direction of the flow at the drain channel and capture, releasing and rupturing a single cell. Experiment for differentiation inducing and analysis of cytosol and organelle.

Tech Classification; Biotech

Patent Status: Patent pending JP

Engineering Level; Theoretical or Documented Research

Licensing: Available exclusive/non exclusive

Cooperative Research /Development Opportunities: Available with the inventors

XIV. Method of Screening Anti-obesity agents, and an Assay of adverse effects of Anti-obesity agents

It is a method for screening antiobesity agents, or agents useful for obesity-related disease, and an assay for adverse effects of antiobesity agents or agents useful for obesity-related disease.

It was discovered that transgenic non-human animal which is enhanced specifically-developed an ubiquitin ligase E4B in central nerve system (ex: cerebral nerve system) becomes useful for an obesity model animal without having gene disruption, and this non-human animal can be a tool for screening anti-obesity drug or curative for obesity-related disease. It was also discovered that a transfectant including an ubiquitin ligase E4B gene or an ubiquitin ligase E4B can be useful for screening anti-obesity drug or curative for obesity-related disease

XV. Micro-bubble Formation with Organic Membrane in a Multiphase Microfluidic System

It is the continuous and uniform organic encapsulated micro bubble generation system in a water flow microchannel including a lumped gas and organic injection junction. The micro-bubble was formed by the blow of organic phase into a water phase in microchannel and the gas was encapsulated in the thin organic membrane.

Multiphase micro chemical systems provide the large interfacial area, fast mixing and fast reaction efficiency to achieve increase performance in microfluidic system.

The diameter and thickness of organic micro bubble were well controlled by the flow rates of water phase and organic phase. The diameter of the gas bubble encapsulated organic membrane was ranged from 110 μm to 220 μm , while the thickness of organic membrane from 4 μm to 16 μm . The generation rate of organic micro bubble was 40 numbers per second with the uniform volume controllable in their volume from 214 pL to 855 pL. The organic membrane is applicative for the chemical reaction media, and the organic bubble is expected to apply as capsules of reactive gas handling in microfluidic system.

XVI. Microsystem, Microopening Film, And System and Method For Analyzing Interaction Between Biomolecules

Invention: A micro-system for controlling liquid flow through a micro liquid channel, a nano-aperture film for detecting and quantifying biomolecular interaction at the level of a single molecule, and device and method for analyzing biomolecular interaction.

This invention has many advantages including:

-Detecting and quantitatively determining interaction between biomolecules with high sensitivity on a single molecule level.

Tech Classification: Biophysics, Biotech

Patent Status: Patent pending JP/US(including related inventions)

Technology Level: Theoretical or Documented Research

Licensing: Available exclusive/non exclusive

Cooperative Research /Development Opportunities: Available with the inventors

XVII. New medical material of reversible volume phase transition

NIR laser-actuation polymer gel composed of poly (N-isopropylacrylamide) and carbon nanotubes.

Possible applications:

- 1) Cell culture sheet in regenerative medical techniques (It is easy to scale from ground substance after incubation.)
- 2) Microfluid device (Nano-shutter/valve, Microchannel plate)
- 3) Actuator (warpage and after tack, catheter and artificial muscle)
- 4) Instrument for medical control release

XVIII. New method for E. coli DNA segment classification on promoters and non-promoters.

System and Program

Invention: Developing a new method for E. coli DNA segment classification on promoters and non-promoters. The algorithm is based on the Independent Component Analysis.

This invention has many advantages including:

- Powerful Prediction in silico
- Easy Promoter Recognition
- High automatic precision (93.7%)
- Available to Protein sequence motif

Tech Classification: Bioinformatics, Software, Biotech

Patent Status: Patent issued JP/US

Technology Level: Theoretical or Documented Research

Licensing: Available exclusive/non exclusive

Cooperative Research /Development Opportunities: Available with the inventors

XIX. Screening method of new pharmaceuticals with fluorescent molecular probes library

The ligands labeled by radioisotopes or fluorescence-based compounds have been applied in analyzing the interactions between proteins, e.g. receptors, and their ligands. The screening of the candidate compounds for pharmaceuticals has been accomplished by the competitive interactions of such candidate compounds and the labeled ones toward the target proteins. This screening method, however, is not suitable in the cases where there are many candidate compounds, since the labeling steps with radioisotopes or fluorescence-based compounds take a lot of time and cost.

The invented screening method is as follows:

- 1) To select the proper fluorescence-based compounds of the intrinsic fluorescence with the potential to interact the target proteins by the docking-study on PCs from the Compounds Library of several million kinds of chemical compounds.
 - 2) To optimize the chemical structures.
 - 3) To screen the candidate compounds with such optimized labeled compounds
- DNase and G protein coupled receptors are illustrated as such target proteins.
This method is valuable in immunology, metabolic disorders, and cancer.

XX. The production method of the spheroid by the board with poly alkyl glycol derivatives coating

The substrates, the surfaces of which are treated with silane coupling agents, are coated by the film layer formed by the spin-coating method, for example, from branched poly alkyl glycol derivatives having polymeric functional groups at molecular tail ends. The substrates are then exposed through photo-masks to form the adhesion sites to living cells with patterning of high accuracy.

The spheroid of extremely high uniformity can be produced effectively by cultivation the parenchymal cells of organs on such substrates. The substrates can also keep the produced spheroids stable on their surfaces for long periods.

This method can be valuable in cardiovascular, dermatology, gastrointestinal, hepatic (liver), musculoskeletal disorders, renal, and respiratory/ pulmonary therapeutic areas.

XXI. The Redox-sensitive Fluorescent Probes Having Isoalloxazine Units

The redox potential in living cells affects their growth, stress responses, cell differentiation, cell proliferation, cell cycle, apoptosis, and so forth. In living cells, the equilibrium between thiol and disulfide plays a critical role in controlling the intracellular redox potential. Therefore, the fluorescent sensors that respond to the redox potential in living cells should become promising tools in the cell biology, the medicinal chemistry, and the diagnoses. The redox potential sensors that consist of a flavin unit, a bora-3a,4a-diaza-s-indacene (BODIPY) moiety, and amino acid linkers such as L-proline, have been designed and synthesized. We found that these BODIPY-based fluorescent sensors reversibly respond (up to 10-fold enhancement in emission) to the equilibriums between thiols and disulfides according to the redox behaviors of the flavin unit.

These redox potential sensors, which are also sensitive to the redox status in living cells, have been demonstrated and are covered by the applied patent.

XXII. Multiplexed Valve Control System for Micro Total Analysis System

An efficient control method of a large number of individually controlled and arrayed pneumatic microvalves is proposed. This method can control (2n) valve matrix with (2n+2) control pressure lines. It is a Lab-on-a-Chip device, a subset of MAMS devices applied in ion channel screening, biochemical and immunoassays, etc.

XXIII. A Patient-specific Endovascular Arteriovenous Simulator

In recent years, surgical simulators have been attracting interest as an alternative to animal testing in the wake of a proposed surgical skill licensing system in neurosurgery and other micro-surgeries and also increasing regulation for animal testing for product evaluation. We developed a technology for reproducing arteriovenous structures including cerebral and coronary vessels with a 3-dimensional transparent silicone. This technology allows fabrication of an entire circulatory system as a simulator for endovascular surgery (min. diameter: 0.8 mm) at 0.013 mm resolution based on CT/MRI imaging.

XXIV. A Patient-specific Biodegradable arterial Scaffold

Biodegradable scaffolds are of great value in tissue engineering. We have developed a method for fabricating patient-specific vascular scaffolds from a biocompatible and biodegradable polymer, poly (L-lactide-co-ε-caprolactone). This method's usefulness is due to flexibility in the choice of materials and vascular configurations. Here, we propose a way to fabricate scaffolds of human carotid arteries by combing the processes of rapid prototyping, lost wax, dip coating, selective dissolution, and salt leaching.

XXV. Two Novel Genes related to Psychiatric Disease and Neuronal Degeneration

We have found two novel genes "piccolo" and "shati" over-expressed in the nucleus accumbens of mice, which was received repeated injection of methamphetamine. The protein inhibits the established the drug addiction induced methamphetamine and morphine. They can depress over release of dopamine and other neuronal transmitters.

These genes depress the addiction induced by morphine and methamphetamine. The mechanisms of the inhibitory effects of drug addiction must be related to the regulation of dopamine transporter. They can keep the dopamine transporter on the cell surface in brain even after the treatment of methamphetamine and morphine. The function of these genes might apply the therapeutic tools for the neuronal or mental disease induced by dopaminergic system dysfunction.

XXVI. Cellular-type Artificial Red Blood Cell/ Hemoglobin Vesicles functioning as Cellular Artificial Oxygen Carrier

This technology has following characteristics:

- No Blood type antigen
- Universal Compatibility
- No pathogen (Highly Safe-Completely Virus/bacteria-Free)
- Low toxicity and prompt metabolism, even after massive infusion
- Long-term Stability (storage at room temperature for years)
- Hb encapsulation shields the effect of toxic Hb
- Sufficient O₂-transport comparable with red blood cells
- Reasonable production expense and cost performance

XXVII. Surgical Self-Training System for Off-Pump Coronary Artery Bypass

The BEAT-S1 provides an effective daily training of anastomotic technique for OPCAB. It also contains quantitative assessment method for the surgical skill. This technology focuses on the development of self-training system for surgical operation and quantitative evaluation of the surgical skills. Our group has developed a self-training system for anastomotic technique in Coronary Artery Bypass Grafting (CABG) to contribute the education of cardiovascular surgery without a risk to patients. The self-Training system consists of following portions:

"YOU CAN", coronary and graft vascular silicone model

"BEAT", innovative beating heart simulator comes with Japanese original artificial muscle actuator.

Quantitative evaluation system based on in vitro mock circulatory system.

This BEAT system comes with innovative SmartBEAT technology using special shape-memory metal to reproduce stabilized heart beating motion.

XXVIII. Surface with Controlled Wettability for Cell Culture

Embryonic stem (ES) cells and mesenchymal stem cells (MSCs) can differentiate into appropriate cells by applying stimuli such as growth factors, extracellular matrixes and cell interactions. The cell aggregation of ES cells causes the cells to differentiate into cardiomyocytes. We developed a droplet cell culture as an easy method of producing ES cell or MSC aggregates using a hydrophobic surface. We also realize a micro patterned surface consisting of hydrophobic regions and cell-culture-treated regions.

XXIX. Novel Anti-tumor Agents

The effective synthesis of new anti-tumor agents was developed. The synthesized Agents showed significant anti-tumor activities against various cancer cell lines.

It was also discovered that the action was released in the time-dependent manner. According to the assessment of the global antitumor activity of our Agents against a variety of human cancer cells using a panel of 39 human cancer cell lines, it was shown that Agent-7 strongly inhibited the growth of several cancer cell lines, such as SF-539, HT-29, DMS114, LOX-IMVI, and MKN74, at low concentrations.

Agent-7 might be potent candidates as anti-tumor agents with different modes of action from existing drugs for cancer treatment because the COMPARE computer algorithm showed a low correlation between the fingerprint of Agent-7 to those of the established anti-cancer drugs. The synthesis of other derivatives and further studies of the anti-tumor activities of these new entries are now in progress.

XXX. Nano and Microtechnology for Gene Delivery to Animal and Plant Cell

We developed a microdevice, which permitted us to construct multifunctional envelope-type nanodevices (MENDs), composed of a compacted DNA core and a lipid bilayer membrane shell, which are considered as promising nonviral vectors for gene therapy applications. We developed a carbon nanotube with immobilized cellulase as an efficient DNA delivery system for plant cells. Microdevice enables us to reduce the time required for fabricating MEND to 20 min, whereas we need 20 h by the conventional technique. Carbon nanotube with cellulase allows us to an efficient gene delivery to the intact plant cell, whereas the conventional technique needs to remove the entire plant cell wall before gene delivery.

PHYSICAL SCIENCE:

XXII. Superheated Steam Generator for high speed sterilization/ disinfection, food processing (oxygen free state)

1. Sterilization and Disinfection

- High speed sterilization of grains, fruit and vegetables
- Medical equipment
- Vaporization of pesticides
- Food Processing
- Biomass related
- Air Sterilization

2. Food Processing

- Cooking and processing of food
- Taste improvement without additives
- Oxygen-free environment/ state, suppressing oxidation and degradation processes
- Retention of ingredients (vitamins and minerals)
- Preservation of moisture and freshness in the food
- The sugar content increases by the α -conformation of starch, and

denaturation of protein

3. Industry/ Manufacturing

- Ceramics, Molding
- Heat source for vacuum formation in molding
- Fabric Dying/ Textiles-related
- Cleaning of liquid crystal/ IT related products
- Highly effective substitution of heat source
- Volume, carbonization reduction
- Prevention of ignition during heating

The technology is a superheated steam generator of an electromagnetic induction type. A frequency of AC power supply has frequency higher than range of 50Hz to 60Hz used for home power supply.

The magnetic body disposed in the conduit through which the steam passes exerts magnetism on the magnetic field lines that are generated by applying a voltage from the high-frequency AC power supply. This reduces the magnitude of eddy currents by a small amount, which produces Joule heat that causes the temperature inside the tank to rise. Thus, by reducing the eddy currents, the temperature inside the tank increases more gradually than conventionally. This enables temperature control to be carried out more accurately as compared with conventional superheated steam generators that have an abrupt temperature increase of the steam.

The technology superheats the steam not only by the Joule heat that is produced by the eddy currents in the tank but also by bringing the steam in contact with the magnetic body that has been heated by the Joule heat. As a result, superheated steam can be generated more efficiently than conventionally, enabling a sufficient amount of high temperature and high pressure steam of not less than 300 °up to 500°C or greater, to be continuously produced for various uses.

XXXI. Sound Source Separation System/ Method, and Acoustic Signal Acquisition Device

This technology divides/ separates a target sound and interfering sound by using a microphone. Specifically, separation is achieved by using a spectrum of the target sound dominant signal and a spectrum

of the target sound inferior signal, and can be used in the following applications:

- Small microphone in a cellular phone
- Operation of car navigation system by voice
- Conducting conference proceedings
- Conversation with the robot

XXXII. Newly Synthesized n-Type Methanofullerene derivatives for High Efficiency Organic Solar Cells

Organic photovoltaic solar cells (OSCs) bare an important potential of development in the search for low-cost modules for the production of domestic electricity. We should concentrate on the principles and techniques needed for their development: organic semiconductors, their transport properties and photophysical characteristics, photovoltaic molecule and polymer structures, device technologies, electrical and optical behavior of the cells, state of the art, limitations and perspectives. Despite some recent record efficiency, research on organic solar cells is still in its infancy when stability and efficiency have to be compared with the performances of silicon cells.

XXXIII. Vapor Cooling Method, Apparatus, and Flow Passage Structure

In the process of boil cooling, boil cooling by nucleate boiling in a temperature area wherein transition boiling may occur is enabled to a larger cooling area. A boil cooling method of the present invention forms, with a surface of an object to be cooled ob or a surface of a heating member in close contact with the surface of the object to be cooled made to serve as a cooling surface, a main flow channel 10A and a sub-flow channel 10B for a cooling liquid from the side of the cooling surface in the above-described order, arranges a plurality of nozzles NZ penetrating a partition wall 10C separating the sub-flow channel 10B and the main flow channel 10A and protruding into the main flow channel 10A in a flow channel direction of the main flow channel, causes tip end parts of individual nozzles NZ to be in the vicinity of or in contact with the cooling

surface, causes a cooling liquid 21 to circulate to the main flow channel 10A and the sub-flow channel 10B, and cools the cooling surface by boiling of the cooling liquid flowing through the main flow channel 10A, and at the same time, supplies the cooling liquid at the side of the sub-flow channel 10B from the side of the sub-flow channel 10B through each of the nozzles NZ to the vicinity of the cooling surface, and cools the cooling liquid in the main flow channel.

XXXIV. Auto Music Selection System Adapted to the User's Preference

It plays tunes that you would like to listen to now. One big problem in current music-listening is selection of tunes from large amount of music. This revolutionary system allows you to listen to music that uses acoustic feature, which can play tunes adapted to user's preference without user's complicated operation and changes of interface of conventional music player.

XXXV. Long-Term Carrier Analysis for Automatic Speech Recognition

The effective use of narrow-band carriers for automatic speech recognizers. Traditional speech analysis methods used by automatic speech recognizers are based on only envelopes of narrowband signals. Thus, there is no method that achieves accurate recognition based on carrier analysis. In this epoch-making invention, the system is effectively achieved by combining multiple neural networks.

XXXVI. Smart Vortex Generator

Vortex generator (VG) is a device designed to delay or prevent flow separation by generating vortices and mixing a flow. Some types of VGs are necessary only in take-off and landing, but generate drag in steady cruise conditions. Smart Vortex Generator (SVG) is a new VG concept, where VG autonomously transforms its position between a vortex-generating position in take-off and landing and a drag-reducing position in steady cruise conditions, without any energy supply, by utilizing functions of shape memory alloy and approximately 70K difference in ambient temperature between the ground and the cruise altitude.

Generating vortices just in phases to need, no need of energy supply, simple mechanism, easily placed even on existing aircraft, possibility of energy conservation, etc.

XXXI. Super High Brightness and High Polarization Spin-polarized Electron Source

High spin-polarized electron beam can be produced by irradiating a GaAs/GaAsP strained superlattice photocathode with specially designed mini-band-structure by circular polarized laser light. High brightness can be simultaneously achieved by focusing the laser light into the diffraction limit (1.2 μ m diameter on the photocathode), which is realized by injecting the laser light from the back-side of photocathode. This polarized electron source can be employed to improve the performance of various type of electron microscopy.

Benefits:

HIGH-BRIGHTNESS of $\sim 10^7$ A \cdot m⁻² \cdot sr⁻¹ \cdot V⁻¹ (This value is better than that of LaB₆ emitter and almost similar to that of field emitter of spin-unpolarized electron sources)

HIGH-POLARIZATION of 90% (world record class) is realized by strain control of the GaAsP buffer layer.

SMALL ENERGY DISPERSION (possibly ≤ 0.1 eV) is realized by NEA surface emission mechanism.

SHORT PULSE ELECTRON BEAM (≥ 1 ps)

XXXIII. Novel Method of Microwave Plasma Generation for Surface Treatment and Coating of Small Halls of metal Parts

We have proposed a novel method of microwave plasma generation for the surface treatment and coating of small halls of metal parts where the inner diameter of hall is less than 10 mm. The newly proposed method takes advantage of a physical phenomenon that Electromagnetic propagate as surface waves along the interface between plasma and ion sheath bounded by metal surface which is electrically biased to a negative voltage against a grounded chamber. By injecting 2.45-GHz microwaves along the inner wall of metallic hall, high-density (electron density, $n_e \sim 10^{11} - 10^{13}$ cm⁻³) plasma column can be sustained inside the small inner surfaces of metal pipes, valves, and mechanical parts.

The proposed method enables the plasma-assisted surface treatments and coatings of small halls of metal parts where the inner diameter of the hall ranges from sub-millimeter to 10 mm. This is

a big benefit, because conventional methods using low-density ($n_e \sim 10^8 - 10^{10} \text{ cm}^{-3}$) plasma can not treat such small halls less than ~ 10 mm in diameter.

- For any questions, please contact the Japan Technology Group at:
Phone: 215-701-6349, Fax: 215-751-0192
Toll-free: 1-866-527-2647 (JAPAN-IP) (U.S. and Canada Only)
Email: info@japantechnologygroup.com