Foundation of global innovation research center for advanced plasma science and technology

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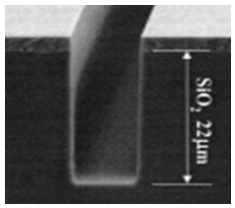
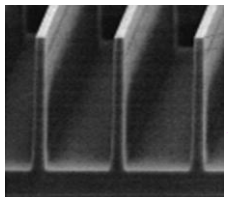
Plasma supports large scale industries

Automobile

Airplane

Medical and Health





Semiconductors

Next generation
LED
Fuel Cell

Medical Application
Biological Application

*High-dencity plasma
*High-precision process
*Fine processing
*Less Damage

*Atmosfer pressure plasma
*At room temperatire
*Large area processing

Plasma etching

Autonomously controlled system

Forming film by plasma

Plasma Nano-science & Technology, sensing and measuring

Semiconductor's contribution on automobile sector

1. The automobile sector is large scale

Volume of production injapan :2008	21 trillion yen	*1
Population in automobile sector in Japan	2.1 million people	*2

*1: http://www.jama.or.jp/industry/four_wheeled/four_wheeled_1t2.html *2: http://www.jama.or.jp/industry/industry/industry_1g1.html

2. A lot of semiconductors are built into the car now. *

- Electronic parts occupy quarter of the costs of the hybrid car.
- The gross volume of the semiconductor used for a hybrid car corresponds to almost six inch size wafer. (Eight times volume of general PC)

* By Touma Fujikawa, http://www.starc.jp/download/forum2007/09_fujikawa.pdf#search='自動車 半導体'

3 More semiconductors will be built into the car in the future.*

- The Internet will be used. :BMW, Chrysler
- Accident prevention system: Volvo
- Telecommunication and entertainment system:Microsoft-Ford and other several companies

* By report of IBM http://www-935.ibm.com/services/us/index.wss/ibvstudy/gbs/a1030141?cntxt=a1000041

The new type of car greatly depends on the semiconductor.

Plasma supports semiconductor manufacturing

Evolution of semiconductors

- Device Quality (speed, power, reliability)
- System on chip
- Low -cost(High throughput)
- Automation(Labor saving line)

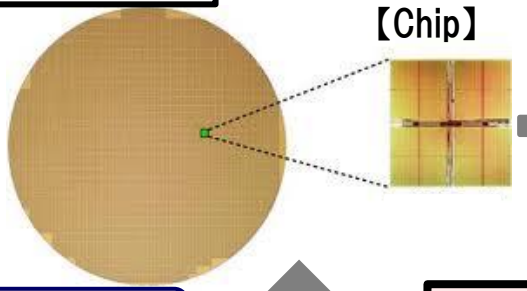
Role of plasma process

- Nano fabrication
- Large size wafer
- Less damage
- Autonomously controlled process

Plasma process for semiconductor manufacturing

【Substrate】

【Chip】



Plasma cleaning

Plasma CVD

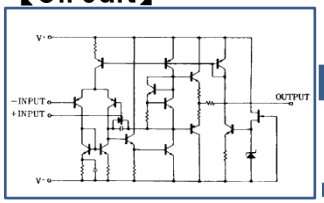
Plasma CVD

Plasma etching

Plasma etching

Cleaning → Forming of device material → Mask transcript → Forming of device → Forming of wiring material → Mask transcript → Forming of wiring → Packaging

【Circuit】



Device layout pattern → Making mask of device

Wiring pattern → Making mask of wiring

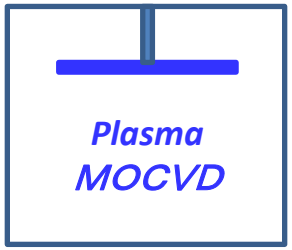
Plasma cleaning

【LSI】

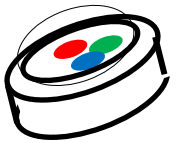
Plasma supports future industries

The plasma activity of nanosized particle with high energy causes the creation of a new material and reduces CO_2.

Next Generation LED

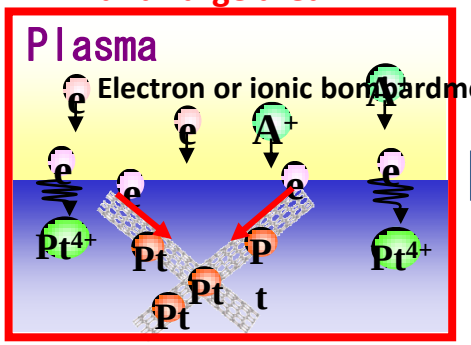


Next generation LED
- Low cost
- Energy saving
- High luminance
- Emission of R・G・B

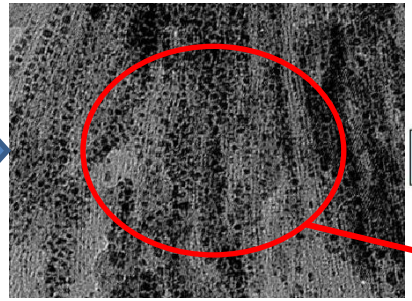


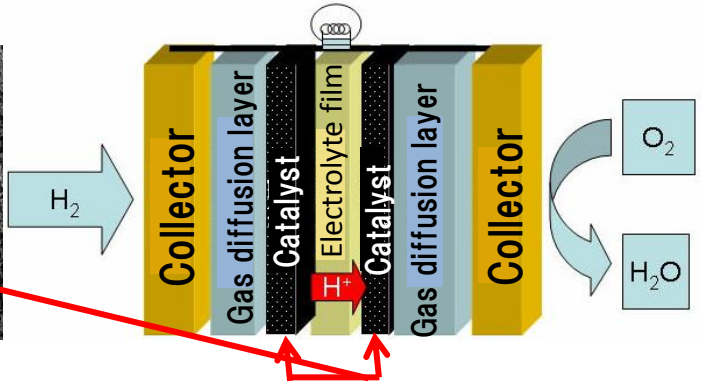
Fuel cell

Low temperature and Large area



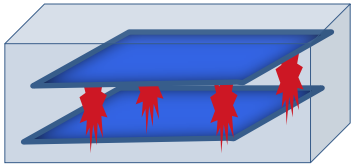
Single dispersed platinum Nano particle





Decompose CO_2

Atmosphere
N_2
O_2
CO_2



Atmosphere
N_2
O_2

☆ Reduces CO_2
☆ Organism generation
(Acetic acid and so on)

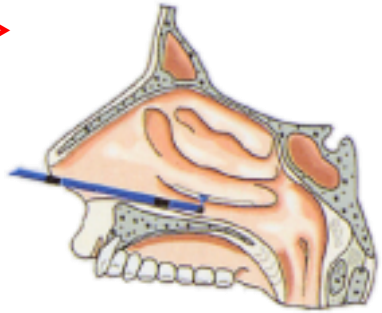
CO_2 removal by making to organism

Plasma supports future health

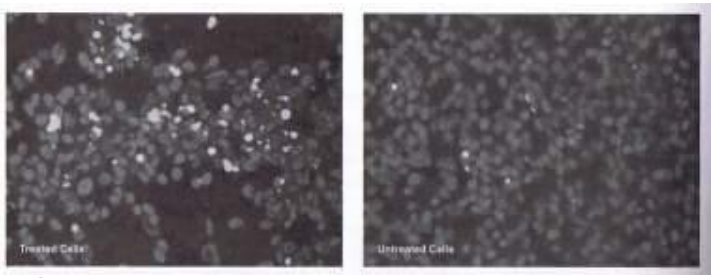
High-energy particles of plasma destroy the pathogen. : Practical use starts.
Plasma will be applied to the use of the improvement of food.

Health and medical treatment

＜ Practical use already ＞
Argon plasma coagulation method
(Blood clot, rhinitis, and hay fever)



The cancer cells are killed out.



With plasma process　　Without plasma process

Improvement of rate of food self-sufficiency and supply of safe food

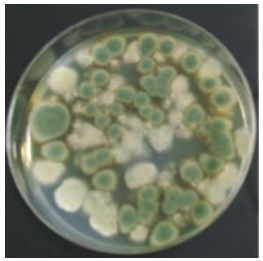
Activation of cell

Without electric stimulation

With electric stimulation

Production increase of mushroom by stimulation by electricity

Inactivation of cell

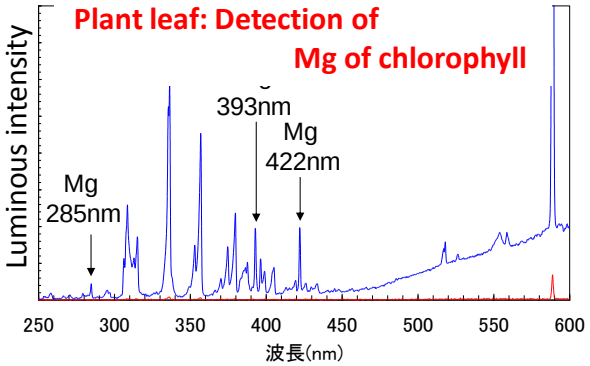


No plasma irradiation

Plasma irradiation

Sterilization of citrous penicillium digitatum disease

Componential analysis by plasma



On-site metallic element analysis of plant

Why is the Foundation of plasma suitable for the Tokai region?

- A lot of enterprises with the infrastructure to put the plasma application to practical use are in the Tokai region.

- There are a lot of laboratories and a technology transfer support organizations, and cooperation with the enterprise is already active.

- The local governments are positive in a coordinated promotion.
  Aich prefecture, Gifu prefecture, Mie prefecture, Nagoya city

- On the Second stage of Tokai Region Nanotechnology Manufacturing Cluster, a basic making of global innovation research center has already been progressing.

Concentration of R&D and Innovation Centers

Technological Innovation Center Gifu

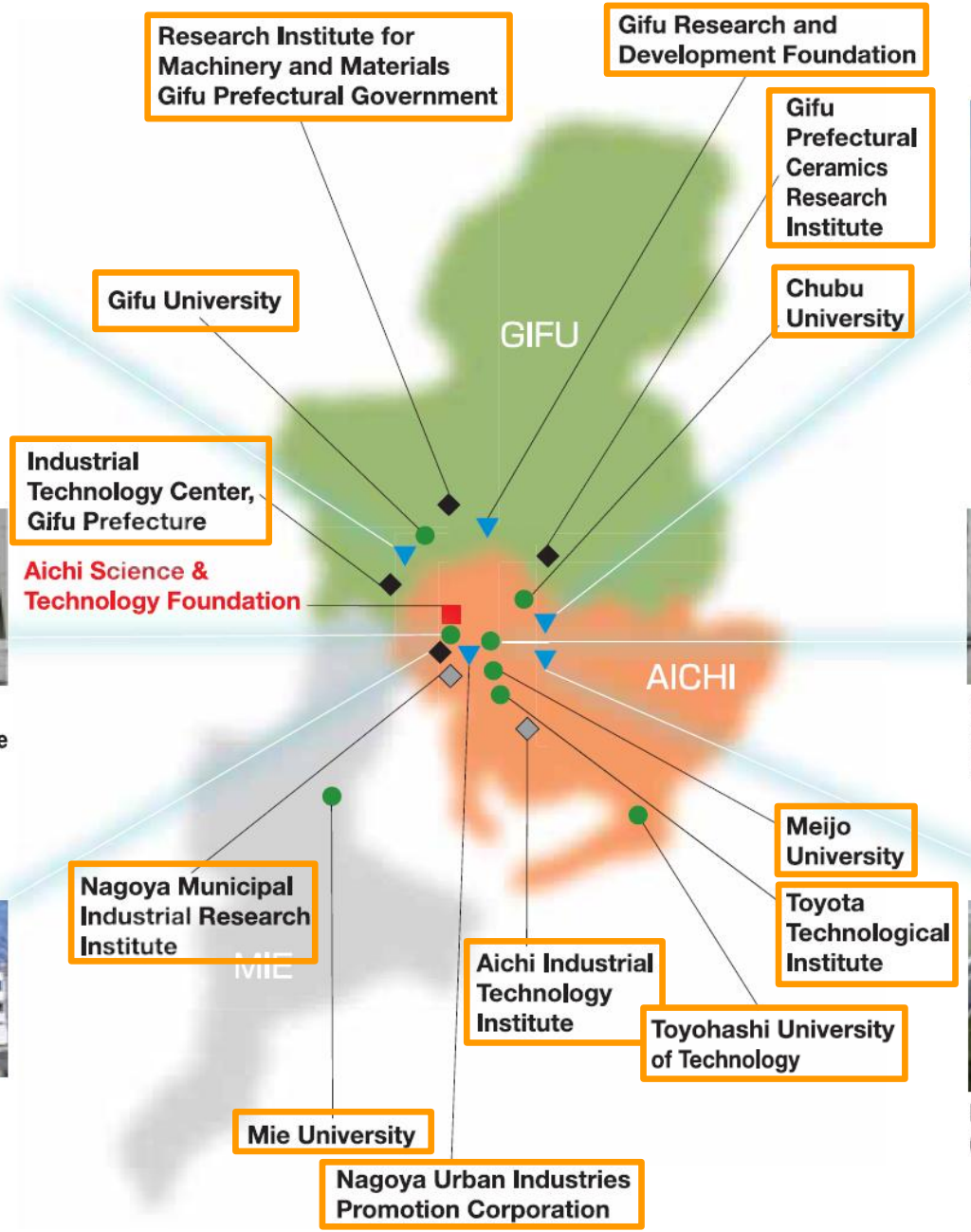
Nagoya Science Park Plasma Center for Industrial Applications

Nagoya Institute of Technology Research Center for Nano-Device and System

Nagoya University Plasma Nanotechnology Research Center

Japan Fine Ceramics Center Nanostructures Research Laboratory

Knowledge Hub (under construction)



Core laboratories and technology transfer support organizations in Tokai region

Knowledge Hub(Advanced core equipment: Synchrotron Radiation Facility)

<Purpose>: Study results such as universities tie to the technical improvement of industry, and the next generation industry is created.

PLAsma Center for Industrial Applications (PLACIA)

<Purpose>: Various equipment related to plasma are used, and the manufacturing by small and medium-sized enterprises is supported.

Gifu technical innovation center

<Purpose>:It aims at the upgrade and the diversification of regional industries by development with the growth field.

Research and development section in universities

【Plasma】

Plasma Nanotechnology Research Center (Nagoya University)

【Nanomaterials】

Green Vehicle Material Research and Development Base (Nagoya University)

Inclination function material laboratory (Nagoya Institute of Technology)

【 Nitrides】

Research Center for Nano-Device and System (Nagoya Institute of Technology)

Electronics-Inspired Interdisciplinary Research Institute(EIIRIS) (Toyohashi University of Technology)

Mission of Research and Development Activities

Tokai Region Nanotechnology Manufacturing Cluster Initiative

– Innovation of Environment-Friendly High-Level Functional Materials and Devices –

★Compliance with environmental regulations

★Yield improvement

Advanced plasma nanotechnology research Foundation

★Energy saving

★Resource saving

Nanomaterials
with novel surface functions

Advanced plasma
fundamental nanotechnology

High-efficient optical
power materials and devices

Second Stage

Advanced Plasma Nanoprocessing

Public Institutes

Enterprises

Nan composites
based on interface engineering

Collaboration with other relevant ministries

Expansion program
Program for forming advanced plasma nanotechnology science research foundation

Internationally linked research organizations

Activities of Universities(Nagoya University, Nagoya Institute of Technology, Meijo University, etc.)

Knowledge accumulation and expansion

First Stage

- Autonomic nanomanufacturing devices
- Advanced plasma nanotechnology
- SAM technology
- Epitaxial crystal growth technology

Role of the Foundation of global innovation research center for advanced plasma Science and technology

(1) International research center where up-to-date plasma applied science that grows fields together in the future evolves.

(2)Platform of plasma investigation that a lot of external organizations can use.

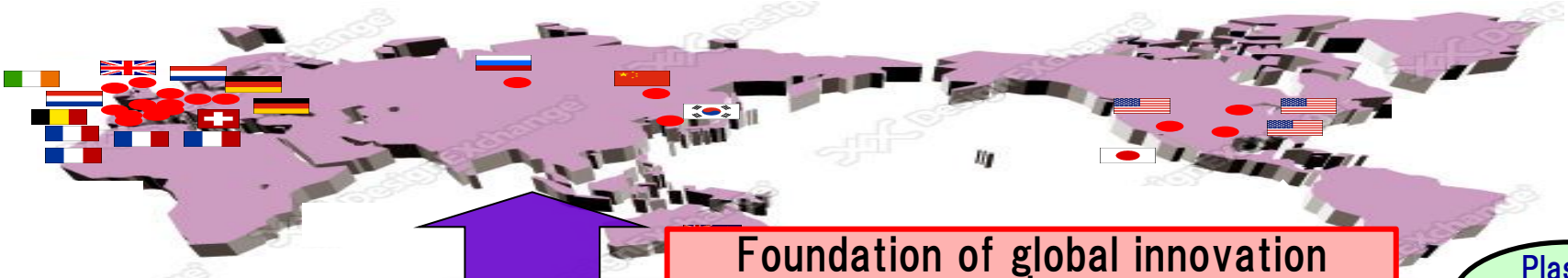
Research of Plasma Science

- Upgrade of plasma process
  - ☆Nano fabrication
  - ☆Less damage
  - ☆High speed
  - ☆Autonomously controlled process
  - ☆Measuring and evaluation

Research of Plasma Application

- Plasma process for next generation devices and materials
  - ☆For GaN devices
  - ☆For nanomaterials
  - ☆For functional materials
- CO_2 reduction
- Medical treatment application

Network of Foundation of global innovation research center for advanced plasma Science and technology



Nagoya University
International Training Program(ITP)
for young researchers
(2008-2012)

Foundation of global innovation research center

International collaboration

Technology transfer

Research
Autonomously controlled plasma etching
Atmosphere presser plasma
Manufacturing nanomaterials by plasma

Regional collaboration

- Plasma Center for Industrial Applications
- Knowledge Hub
- Gifu Technical Innovation Center
- Other technology transfer support organizations

Enterprises

Plasma medical treatment

【Nagoya University】
University Hospital

【Nagoya University】
School of Medicine

Next generation LED

Fuel cell

GaN devices

【Nagoya Institute of Technology】
Research Center for Nano-Device and System

【Toyohashi University of Technology】
EIIRIS

【Mie University】
The Center of Ultimate Technology on nano-Electoronics

【Meijo Unovercity】
LED Center

【Nagoya University】
Green Vehicle Material Research and Development Base

Advanced Materials Innovation Center

A core device of Foundation of global innovation research center

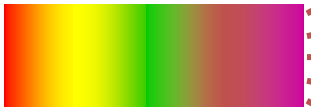
Autonomic Nano-Production Device for Plasma Processing

Optimum Process-Control System

Autonomic Control

Atom/Molecule Sensing System

Compact Radical Monitoring Sensor



Electrode

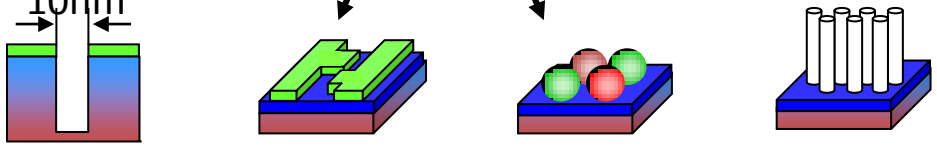
radicals

Plasma Reaction Space

Multi-channel Sensor Allay

Sub.Temp. Sensor

Film Monitoring Sensors for the Thickness, Structure, composition, etc



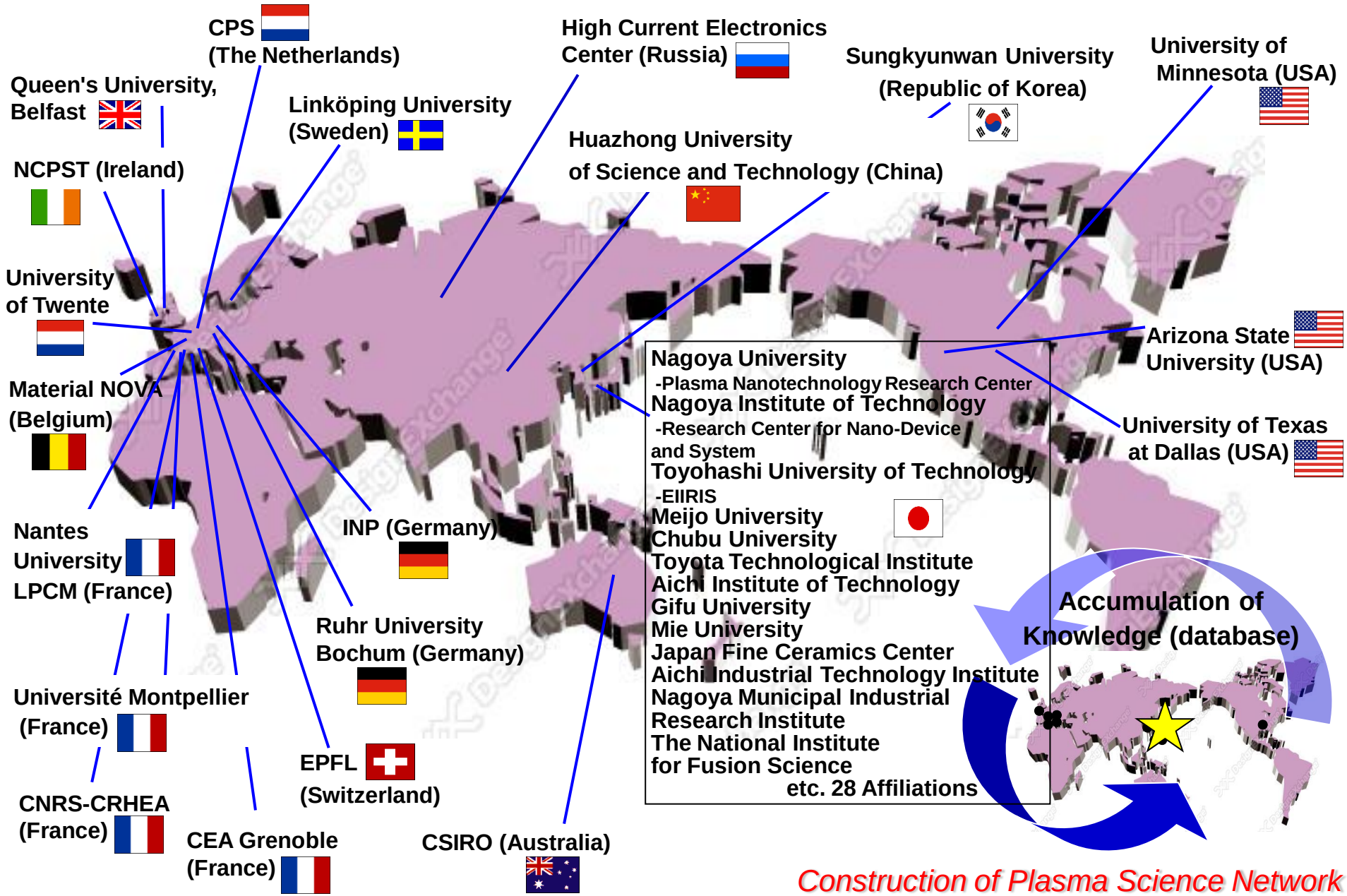
Nano processing with a high degree of accuracy

Radicals in Plasma Reaction Space are Key Players of Plasma Processing

Quality improvement

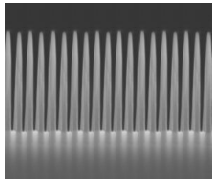
The international cooperation is progressing.

(Collaboration with 28 affiliations in Japan and 20 Affiliations in the world)



Construction of Plasma Science Network

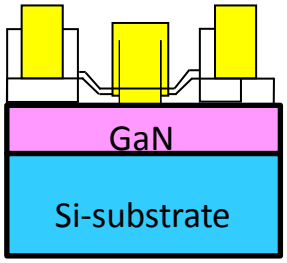
Application of highly effective semiconductor(GaN) using plasma process



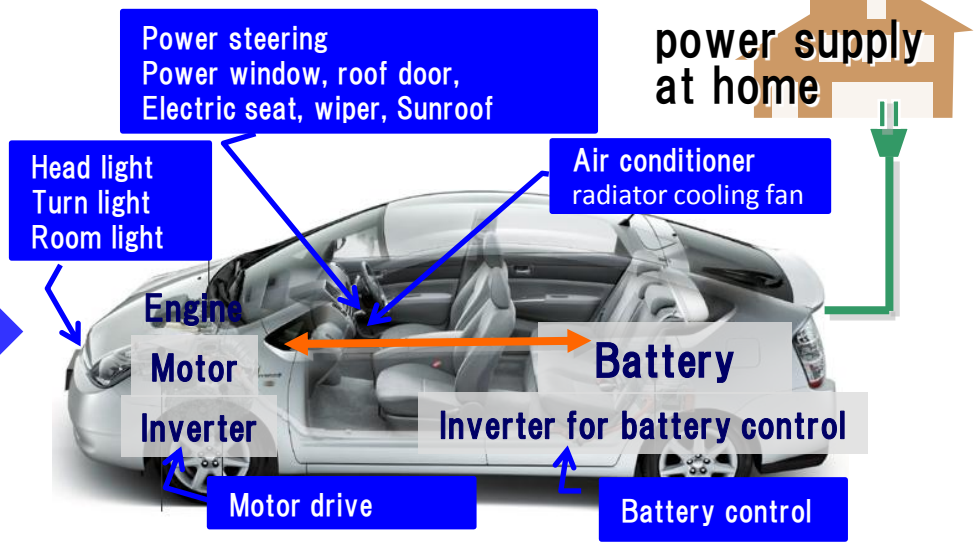
Nano process
Less damage

Plasma process for GaN device manufacturing

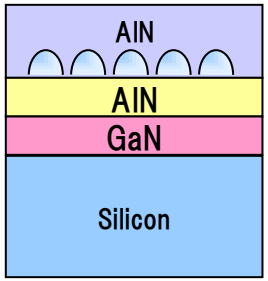
highly effective semiconductor(GaN)



Plug-in hybrid car



High speed and high-quality material generation



LED with Low power consumption, low-cost, high luminance, and high color rendering properties

CO_2 reduction after ten years

CO2 reduction in 2020 ⇒5. 5%

CO_2 reduction in 2020
～ 40 million ton/year
(About 3% reduction)

Electric power conversion and storing

- Highly effective semiconductor (For electric car and hybrid car)
- Battery

CO_2 reduction in 2020
～ 30 million ton/year
(About 2% reduction)

Communication/lighting

- Element for wireless and high-speed communication
- Next generation LED

CO_2reduction

- Car industry
- Airplane industry
- others

Environmental measurement

Environmental clean-up

Manufacturing

- LSI process innovation
- Low temperature plasma

New energy

- Solar-electric power generation
- Biomass fuel
- Thermoelectric conversion

CO_2 reduction in 2020
～ Seven million ton/year
(About 0.5 % reduction)

The world of future where plasma science is achieved