

Plasma Science Global Innovation Bases



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GOAL OF THE SECOND STAGE KNOWLEDGE CLUSTER

Innovation of Environment Friendly Highly Functional Materials and Devices Leading the World

Aichi Nagoya Tokai Region Industry Integration and Expansion

(Devices and Materials Supporting Automobiles, Aircrafts and Machineries)

Gifu Mie

Environmental Control
and
Yield Improvement

**Advanced Plasma Nanotechnology
Science Research Foundation**

Energy Conservation
and
Resource Saving

**THE SECOND STAGE KNOWLEDGE CLUSTER
(TOKAI REGION NANOTECHNOLOGY MANUFACTURING CLUSTER)** Total Budget 80 M\$ for 5 years

**Advanced Nano Materials
and Nanodevices by
Surface Functioning
Development**

**Advanced Plasma
Fundamental Nanotechnology
Development**

**High-Efficiency Optical and
Power Materials and
Devices Development**

Advanced Plasma Nanotechnology Processing

Public Institutes

Collaboration
Companies

(Collaboration with Relevant Ministries)
**Interface Controlled Nanocomposite Materials
Development**

(International Program)
**Advanced Plasma Nanotechnology
Science Research Foundation**

International
Collaboration
Affiliations

Nagoya University

Nagoya Institute of Technology

Gifu University

Mie University

The University of Tokushima

**Toyohashi University of
Technology**

Meijo University

**Toyota Technological
Institute**

Chubu University

**Tokyo University of
Science**

Wakayama University

Knowledge Integration and Expansion: Integration of Researchers, Emphasis and Narrowing-down of Research Areas

The First Stage Knowledge Cluster

Autonomic Nano-Production Devices and Products

Advanced Plasma
Nanotechnology

SAM Growth
Technology

Epitaxial Crystal
Growth Technology

Research Seeds: Nagoya University, Nagoya Institute of Technology, Meijo University



Global Innovations

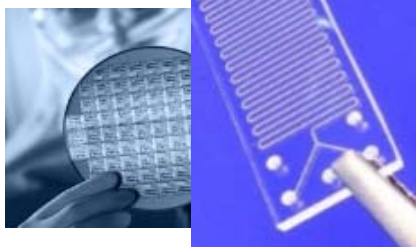
**Material-Device
Innovation**



Well being Innovation



**Environment
Innovation**



Plasma Sciences



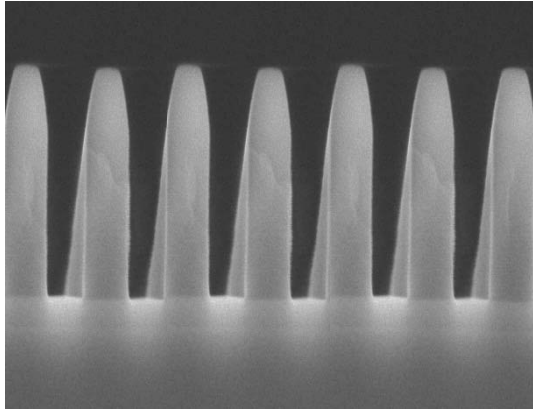
Medicine Innovation

**Agriculture
Fishery Innovation**



Manufacturing by Try and Error

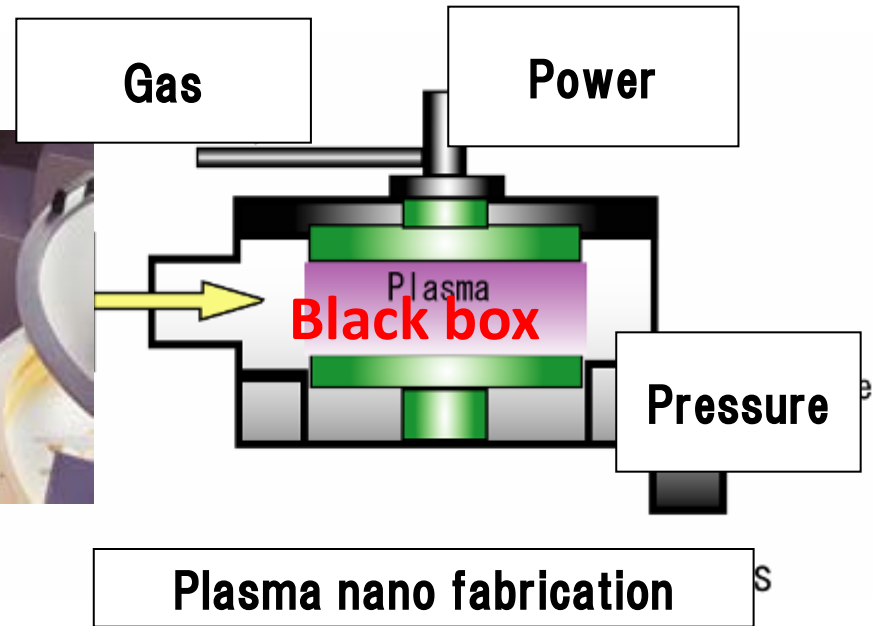
Plasmas were employed
over 70% of ULSI process steps.



To seek for the optimum
conditions.



Large size wafer



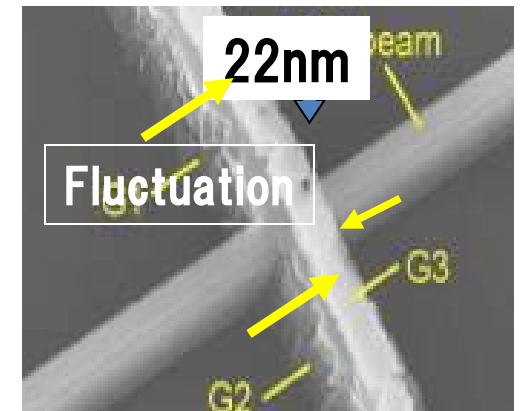
Waste of huge material, energy and resource
Global warming

Plasma is still like a black box.

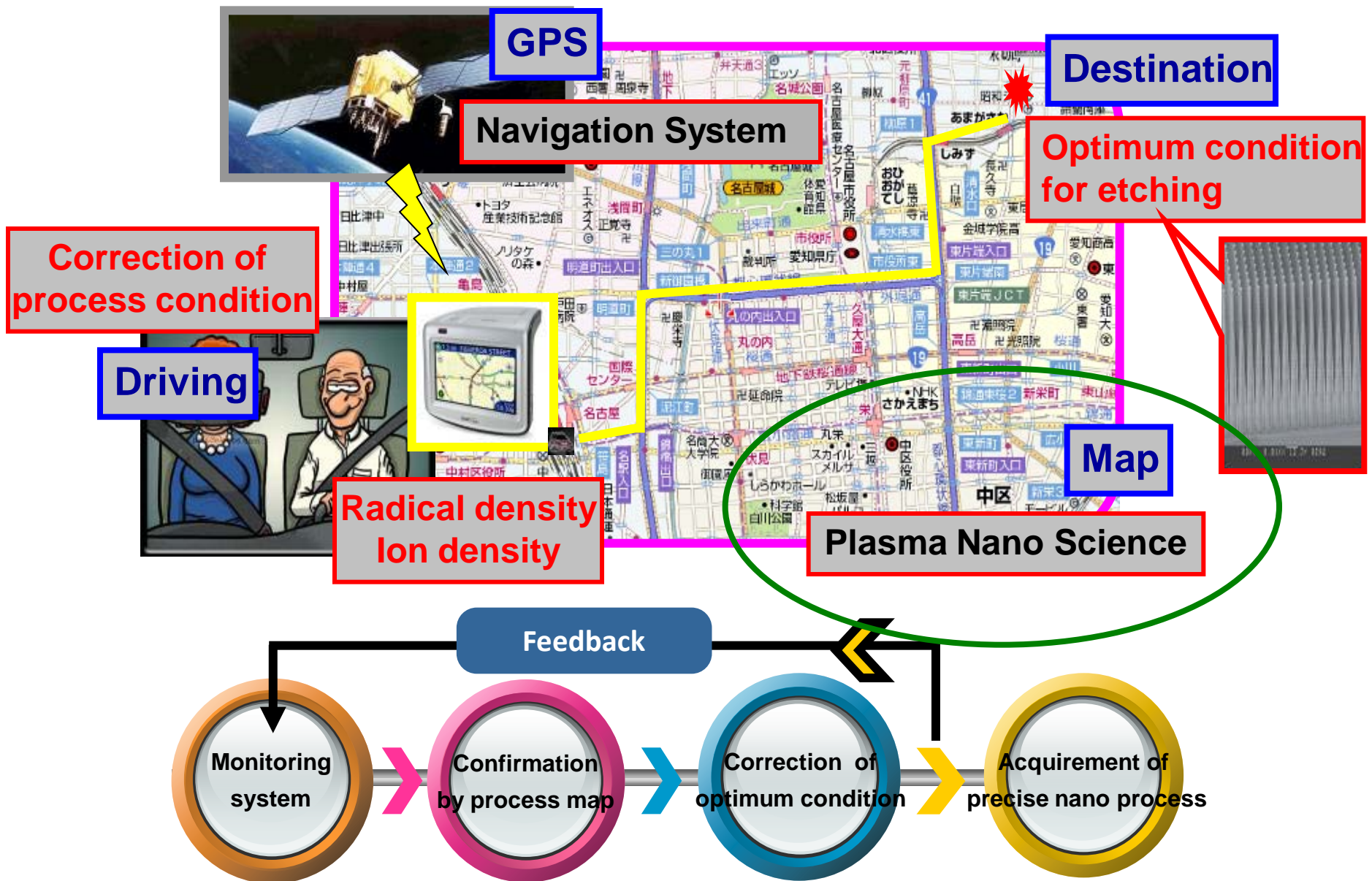
Nano Process : Precisely controlling with atomic levels



Manufacturing on the basis of
Plasma Nano-Science

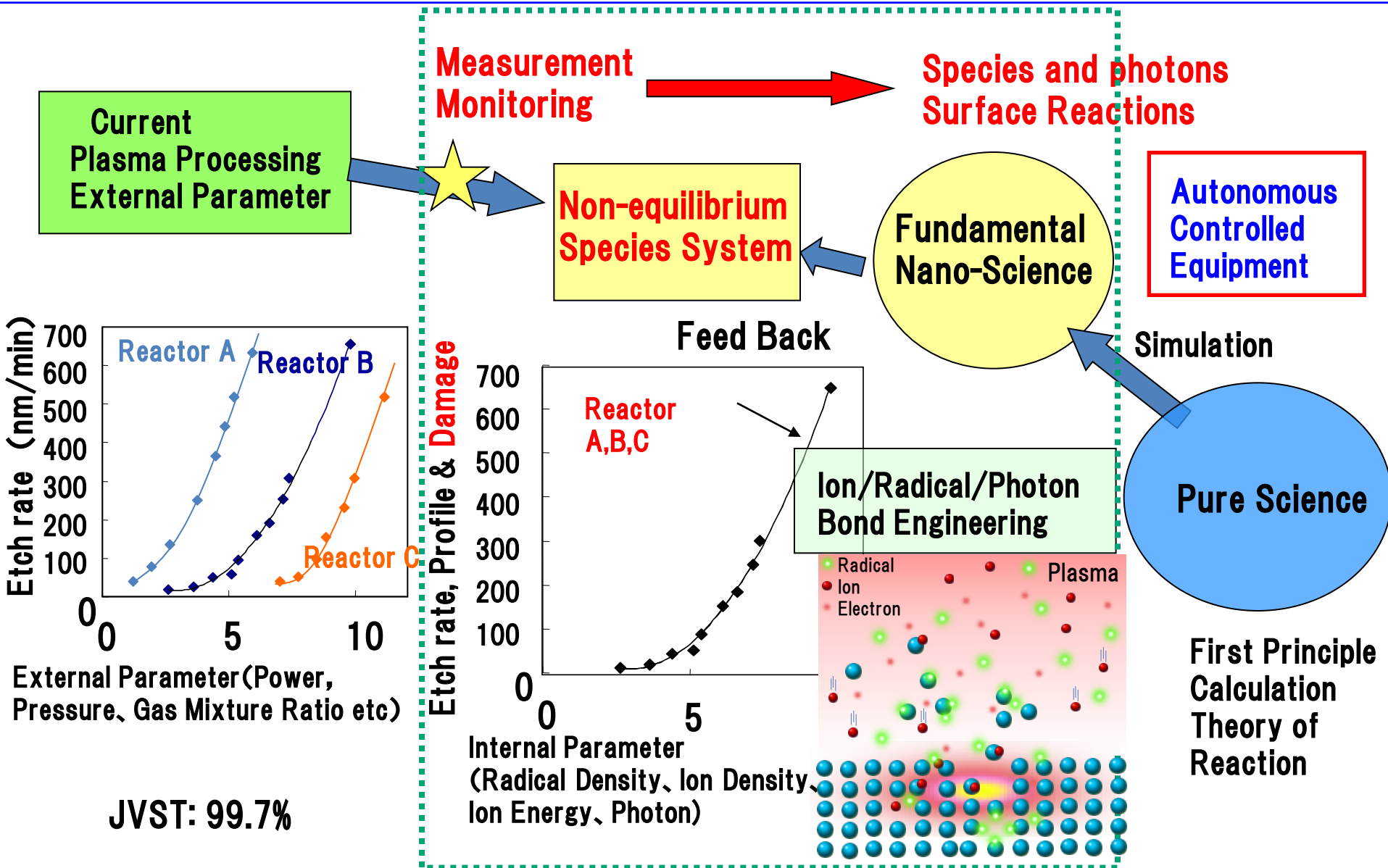


Autonomic Nano-Production Device for Plasma Processing with navigation system



Conclusion: Foundation of Plasma Nano Science

In-situ analysis Species vs Surface Reactions



Perspective of Plasma Science Global Innovations

Innovation of System, Process and Material
Attributed to Own Idea
Synergy by International Team Lab

Manufacturing Science
World Wide

Vigorous and Dynamic Plasma Community
Transfer Intelligence to Industries
Integration of Academy
Cultivation of Human Resources

Nagoya University Plasma Nanotechnology Center (PLANT) since 2006

17 Profs and advanced plasma equipment over 90 are working

472 patents (93 Registered)

4th Floor
(350m²)



3rd Floor
(350m²)

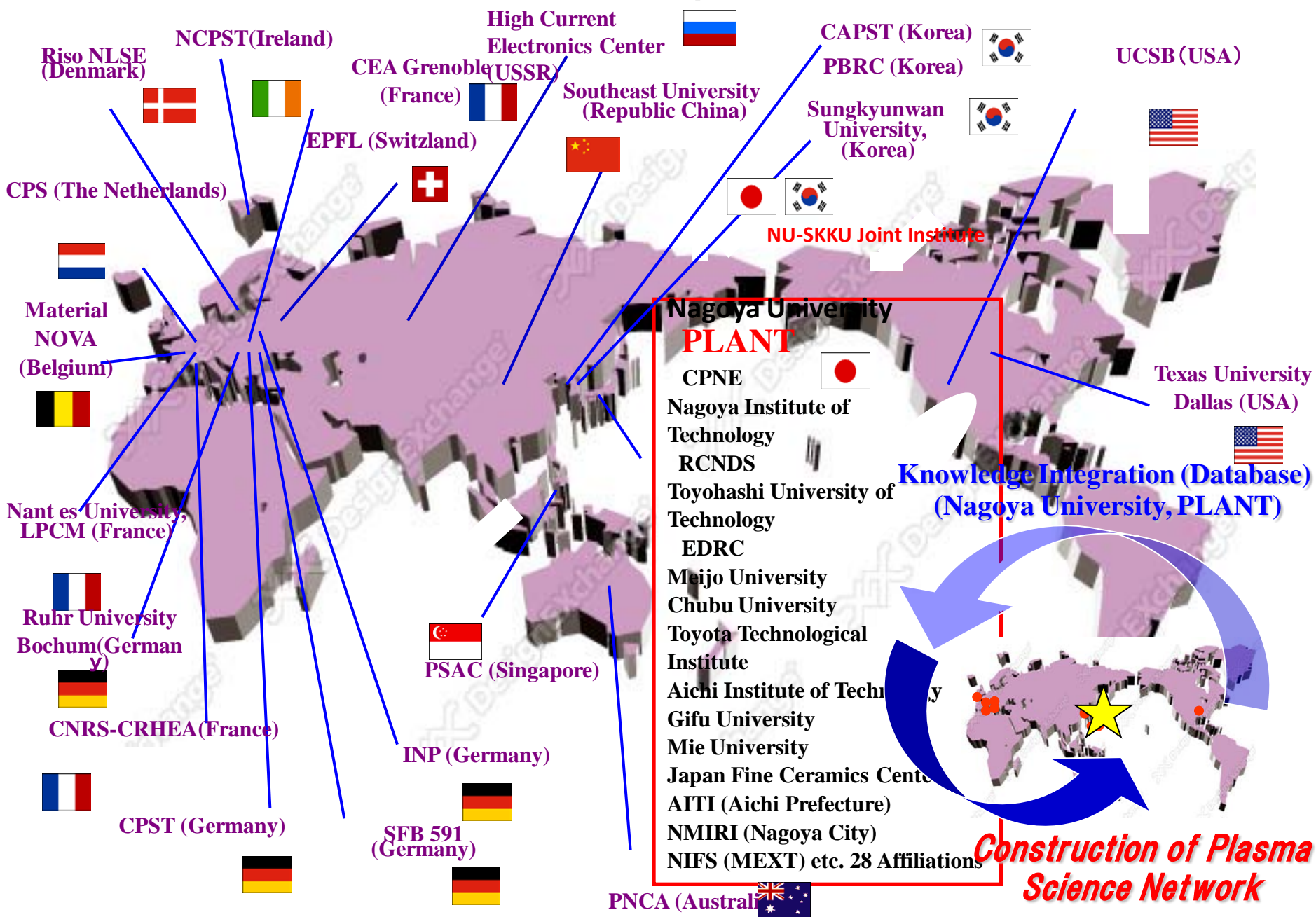


Plasma Center for Industrial Applications (PLACIA)



Unique Technical Transferring System
From Science to Global Business
Company : 303, Member 667

Advanced Plasma Nanotechnology Science Cluster Research Bases (Collaboration with 28 affiliations in Japan and 23 Affiliations in the world)



Road Map : Plasma Process Technology

	2010	2020	2030	2040
Output Products, Application	Device dimension 35nm	25nm	10nm	5nm
				2.5nm
				1nm
	Compound Semiconductor	Nano-scale Logic Device	Molecular Device	Atomic Device
	High Definition Flexible Display	3-Dimension Display	Ubiquitous Display	Projection in Brain
Development Manufacturing technology	Health Care Chip	Drug-Delivery system	Bio-Mechanics-fusion	Bio-Self-assembly
	Ultra Efficient Solar Cell	Super Efficient Photoelectric/Thermoelectric conversion	New Energy Source	
	Environmental Detox	Hi-Efficient Agricultural/Marine production	Nano Detox	Global Restoration
	Hi-Efficient Manufac. Tool	1 Atom-Accurate Manufac. Tool	Organic/Bio Self Assemble Manufac. Tool	
	Engineering makes Seeds(Principle) to Production Technology			
Research Seeds	Hi Precision / Hi Productivity / Large Area / Stable Production Technology			
	Development for Feedback Control Technology using Monitor and Simulation			
	Navigation Assist Process Tuning → Pin-Point Control → Pin-Point Design			
	Monitor-, Simulator - Friendly Reactor Design			
	Top-down Process			
	Principle of Species Generation Control	Nano, μ - m scale, Lo - Hi Pressure, Gas/Liquid/Solid(Surface), Phase mix		
	Principle of Surface Reaction	1 Atom/Molecule Control	Control of Functional Unit	Organic/Bio Material
	Monochroic Flux	Vertical/Lateral Atomically-controlled Depo/Etch	Bio Molecular Manipulation	
	Bottom-Up Process			
	Principle of Selective Reaction/Self-Assemble	Clarify & Realize of No-defect / Ultra Hi-Speed reaction		
	Common Basic Technology	Ultimate Controlled Beam/Process for Perfect No-Defect Hi-Speed Self-Assembled films / Materials	Defect Self-healing Synergic Reaction in Large area	
	Diagnostics	Ultimate precise No Disturb. 3D Flash Diag.	Nano struct./Elec.Character. Diag.	Prognostic Diag.
	Simulation	Ultimate correct	Multi Scaled Time/Space Flash (intuitive) Algorithm	
	DATABASE : Atom, Molecule Reaction / Surface Reaction / Mechanism			

Innovation

**Rapid Impact in Japan:
Aging Population Combined with the Diminishing
Number of Children**

**Concept of Plant and Building
for Plasma Research and Its Applications
to Industries in University to make global innovations**

What system is ideal?

For the Sake of Sustainable Progress of Humankind



On the basis of Plasma Science & Technology