Division of Electrical Engineering and Computer Science	Research field	Fundamentals and Applications of Plasmas	Lab. ID EC20
Laboratory web site	http://epel.w3.kanazawa-u.ac.jp/		

Research subjects

We have studied fundamentals and applications of different types of plasmas: from high-density high heat flux plasmas to low-density low power density plasmas for their next generation applications. The research subjects are described as follows:
1. Fusion plasma. ----In this field, we have been investigating interactions between a plasma and wall in a helical type fusion plasma device or a linear type plasma device, improvement of plasma confinement ability by controlling electromagnetic fields applications, understanding on dust dynamics and ablation properties in diverter plasmas.
2. High-density high temperature plasma for advanced applications ---- In this field, we have studied on new developments of different types of inductively coupled thermal plasmas and their applications to materials processings such as high-speed surface modification, ultra-rapid film deposition, large-scale nanopowder synthesis. Arc/ thermal plasma quenching properties are also subjects using polymer ablation/spallation for circuit breakers. A multi-phase plasma is one keyword for innovative advanced applications with solid, liquid, gas and plasma phases.
3. High-pressure non-equilibrium plasma application to industrical innovation ----- In this field, we are interested in developing novel applications using plasma-liquid interactions. We are developing two kinds of plasma sources such as a novel high-density non-equilibrium plasmas by microwave excitation using liquid as source gas and a plasma jet type using a low frequency and microwave power sources. These can be suitable to low-temperature materials processing and also will provide innovation for bio and medical applications as well as semiconductor fabrication process.

Master/Doctor course: Education policy, curriculum, typical activity in the laboratory

Experiemntal and numerical appoarches in high-density plasmas and low-pressure non-equilibium plasma technologies in our laboratory offer you big opportunities to learn electrical/electronic circuits, control theories, electromagnetic field, fluid dynamics, chemical reactions, atomic and molecular theories, thermodynamics, spectroscopic theories, as well as plasma physics and technologies. Programming can be done to simulate hydrodynamics of plasmas and also for signal processings.

Daily life in the laboratory, etc.

Students in our laboratory can learn experimental and numerical simulation approaches to plasma technologies from designs of plasma devices, measurement systems, programming for plasma fluid dynamics. We have a meeting about our reasearch progresses to discuss solutions for the next step. In addition, we have a weekly interactive lecture to learn fundamentals of plasma physics to enhance the abilities of all colleagues and students. Introduction of recent journal paper about plasma technologies by each of members provides recent knowledgements to everyone in our laboratory. We welcome to have collaboration works with some companies to know industrial needs to be solved.

Message or comments by the laboratory faculty staffs

We have cordially been welcoming for members who would like to study and progress our subjects about plasma physics and plasma application together with us.

Recent Master theses in these 3 years (+ more if appropriate)

year.month	Thesis title (including English translation of Japanese thesis title)
2017.3	Development of high-efficient inactivation method for particulate food by non-equilibrium plasma
2017.3	Evaluation of heat shielding performance by ablation from ablative fibers and its applications to arc-resistive fabrics
2017.3	Suppression mechanism of carbon film growth by nitrogen addition into hydrogen and methane mixture plasmas
2017.3	Development of a compact water plasma ashing machine and investigations of its ashing process mechanism
2017.3	Study on the performance improvement of plasma arc cutting machine
2017.3	New numerical modelling of a complex system between arc plasmas and evaporated materials involving rapid vaporization of solid
2017.3	Ultra-rapid oxidation/nitridation of a long substrate by loop type of induction thermal plasmas and thermofluid simulation on the plasma in the torch
2017.3	Numerical thermofluid simulation and experimental study on rapidly decaying arcs in various gas flow
2016.3	Development of Power Reduction Methods in Microwave Excited Plasma Using Water as Source
2016.3	Development of control method for chemical species induced in liquid by irradiation of low frequency non-thermal atmospheric pressure plasma jet
2016.3	Development of the Loop Type of Induction Thermal Plasmas System for Large Area Nitridation Processing
2016.3	High Production-Rate Synthesis of Nanopowder using Modulated Induction Thermal Plasmas and Fundamental Study on Feedstock Evaporation
2016.3	Study on the Performance Improvement of Arc Torch for Plasma Arc Cutting
2016.3	Parallel-Coil Type Applicator with Air-Cooling System for Medical Treatment to Enhance High-Frequency Magnetic Fields
2016.3	Fundamentals of High-Power Ar Induction Thermal Plasmas with CH4/H2 Injection and their Applications to Diamond Film Growth
2016.3	Study on Dielectric Barrier Discharges in Gas Phase and inside Bubbles in Water Generated by Using Silicon Diode for Alternating Current
2016.3	Measuring System of Minute Remnant Magnetization under Geomagnetism and Applications to Measurement of Inrush Currents
2015.3	Suppression of hydrogen isotope retention into hydrocarbon film under simulated environment of nuclear fusion reactor
2015.3	Study on Hydrocarbon Film Growth Control by Reactive Hydrogen Plasma Containing Carbon and Nitrogen
2015.3	Large scale synthesis of metallic ion doped TiO2 nanopowder using PMITP-TCFF method
2015.3	Fundamental evaluation on characteristics of decaying arc plasmas using gas/solid arc quenching media
2015.3	Radical control in pulse-modulated induction thermal plasma with gas/solid feedstock and their application to diamond film deposition.
2014.3	Suppression of Magnetic Arc Blow and Control of Hafnium Cathode Erosion in Plasma Arc Cutting Torch
2014.3	Carbon Film Formation and Hydrogen Retention Control with H-C-N Reactive Species
2014.3	Development of low environmentally-friendly high-speed photoresist removal process using microwave excited bubble plasma under water
2014.3	Development of a planar type of modulated induction thermal plasma torch for large area materials processing
2014.3	A study on rapid ablation of synthetic fabric by irradiation of thermal plasma and its appication to heat sheilding
2013.3	Characteristics of anode heat-input and suppression of magnetic arc blow in plasma arc cutting
2013.3	Numerical and experimental apporoaches to the decaying arc plasma in nozzle with gas flow
2013.3	Tempospatial control of high-temperature region by using a tandem-type of induction thermal plasma
2013.3	Enhancement of Generating Non-equilibrium Atmospheric Pressure Plasma and Application for Hydrocarbon Combustion and Environment Technology
2013.3	Development of large amount of nanopowder synthesis method using modulated indution thermal plasma with intermittent feedstock feeding
2013.3	Fundamental study on dynamic behavior of spallation particles emitted from polymer surface by irradiation of thermal plasmas
2013.3	Dynamic behaviours of high-density radicals in modulated induction thermal plasmas and their application to carbon film fabrication

Recent Doctoral theses in these 3 years (+ more if appropriate)

year.month	Thesis title (including English translation of Japanese thesis title)
2017.3	Development of a planar type of modulated inductively coupled thermal plasma for uniform oxidation processing
2013.3	Numerical Simulation of Thermo-Fluid Fields with Cathode Evaporation in a Plasma Arc Cutting Torch

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