

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-1

Title:

Effect of Frequency on Ion Generation Rate of Corona Discharge Air Ionizer

Affiliation:

The Polytechnic University

Author(s):

○Yasuna HIRATA, Kazuo OKANO

Abstract:

The emitter current sensor was proposed for measuring the ion generation rates of corona discharge air ionizers to investigate the effects of the operating condition on the neutralization performance. The sensor consists of two regions; the high voltage region for detecting the emitter current, and the low voltage region for measuring the wave form of the emitter current by using oscilloscope. The ion generation rates were obtained from the difference between the total current and the displacement current. The dependence of the frequency on the ion generation rate was measured by using the emitter current sensor. The ion generation rate increased with increasing the operating frequency.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-2

Title:

Effect of atmospheric gas on the neutralization characteristics of corona discharge ionizer

Affiliation:

Ibaraki University *, The Polytechnic University * *

Author(s):

○Yudi KRISTANTO *, Naoyuki SATO * Takashi IKEHATA *,
Kazuo Okano * *

Abstract:

In the present paper we report the effect of environment gas on the performance of a corona ionizer. The atmosphere gasses used are ambient air, pure nitrogen and nitrogen-oxygen mixture gasses with the relative oxygen content of 1% - 12.5% at atmospheric pressure. The characteristics were evaluated by measuring the ionizer I- V characteristic, the product final voltage VPF, the rippled voltage VS and the neutralization current IN. The corona ionizer was operated at DC ± 1 kV \sim ± 9 kV for the I-V characteristic measurement and at ± 6 kV (rectangular wave) in the frequency range of 5 Hz \sim 20 Hz for the other measurements. Results show that the negative current in the pure nitrogen environment is significantly greater than the positive current and the positive and negative currents in ambient air. The product final voltage VPF in pure nitrogen also shows a significant negative value around -2 kV and by introducing some amount of oxygen into pure nitrogen, it becomes lower, around -0.3 kV similar to that in ambient air.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-3

Title:

Development of low-particle-emission corona discharge ionizer by electrode heating.Part.2

Affiliation:

Technical R&D Center, Techno Ryowa Ltd.* , Dept. Environmental and Life Sciences, Toyohashi University of Technology**

Author(s):

○Tomokatsu SATO* , Masanori SUZUKI* , Akira MIZUNO**

Abstract:

Corona discharge type ionizers are widely utilized in clean rooms, such as those for LCD manufacturing processes. However, these ionizers are also known to generate particles due to deposition of particles to tip of the electrodes and then these particles are eventually released into air of clean room. In order to resolve this problem, we devised a method for inhibiting the deposition of particles to tip of the electrodes by heating the electrodes to utilize the thermophoretic force to repel fine particles towards low temperature region. In the previous paper, we conducted an experiment on heating an ionizer electrode to approximately 90°C. The result indicated that, compared to a non-heated case, amount of the particle-deposit on the electrode was reduced. In this paper, we devised a practical heating method of ionizer electrode. As a result of this experiment, we found that it was possible to heat the electrode to the desired temperature.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-4

Title:

Study on discharge current and radiated electromagnetic wave by electro static discharge of conductive polycarbonate

Affiliation:

*Suzuka National College of Technology, **YUKA DENSH I Co., Ltd.

Author(s):

Takayoshi OHTSU*, Hideyuki DOYAMA* and Kouichi Sagiaka**

Abstract:

The robustness of ESD (electrostatic-discharge) of the electronics device becomes weak year by year due to increasing of data transfer rate, and a countermeasure in the system level is demanded. It is very important the selection of the material for the system. In this study, the polycarbonate with CF (carbon fiber) ,CNF (carbon nano fiber) and CNT(carbon nano-tube) were used for comparison of discharge current and radiated electromagnetic wave. The approach speed between a sample and a probe was controlled by a robot arm system. The discharge current of all were decreased with increasing of the surface resistance. The discharge current of CNT was the lowest of all. The radiated electromagnetic waves of all were decreased with increasing of the surface resistance. The radiated electromagnetic wave by ESD of CNT was the lowest of all also. For ESD sensitive device, the polycarbonate with CNT is superior to that with CNF or CF from the viewpoint of the discharge current and the radiation electromagnetic wave.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-5

Title:

Humidity effect on ozone generation by low-pressure mercury lamp

Affiliation:

The University of Tokyo

Author(s):

○Yusuke TOKUMITU, Ryo ONO

Abstract:

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-6

Title:

On the mode transition between brush and propagating brush discharges – A preliminary experiment

Affiliation:

JNIOOSH

Author(s):

A. Ohsawa

Abstract:

We report preliminary experimental results on the transition between the modes of brush and propagating brush discharges occur on charged insulting films or coats on a grounded metal. A unified transition criterion with the consideration of the thickness and dielectric constant of coat materials is presented for the risk assessment of the ignition by the discharges, in which the charge transferred by the discharges can be expressed by a function of the initially accumulated electrostatic energy per unit area of the charged coats.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-7

Title:

An experimental demonstration of the minimisation of offset voltage for corona ionisers

Affiliation:

JNIOOSH*, Kasuga Denki Inc**.

Author(s):

○A. Ohsawa*, N. Nomura**

Abstract:

We present an experimental demonstration of a prospective idea obtained from 2-D electrohydrodynamic simulations in which continuously emitting balanced positive and negative ions from corona ionisers can yield zero offset voltage.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-8

Title:

Detection of Incendiary Electrostatic Discharges inside Powder Storage Silo by Using Photosensor-type Electrostatic Discharge detector

Affiliation:

*National Institute of Occupational Safety and Health, Japan, **Kasuga Denki INC.

Author(s):

○Kwangseok CHOI*, Tomofumi MOGAMI ** and Teruo SUZUKI**

Abstract:

To detect incendiary electrostatic discharges generated by polymer granules within a metal silo, we developed a novel and simple electrostatic discharge detector that utilizes a photosensor. The novel detector consists of a photosensor module in a metal cylinder, an optical band-pass filter (λ : 337 nm), a quartz glass, a power supply, an amplifier for the photosensor module, and a digital oscilloscope. In this study, we conducted experiments at a real pneumatic powder transport facility including a metal silo to evaluate the novel detector using polypropylene granules. To determine the performance of the novel detector, we observed the electrostatic discharge within the metal silo using a conventional image-intensifier system. The results obtained from the experiments show that the novel detector worked well in this study. The signals obtained with the novel detector were identical to the incendiary electrostatic discharges obtained with the conventional image-intensifier system. The greatest advantage of this novel detector is that it is effective even when placed under the sunlight.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aD-9

Title:

Experimental study on the relationship between the charge amount of polypropylene granules and electrostatic discharges while silo loading

Affiliation:

* JNIOH,** Kasuga Denki INC,

Author(s):

○ Kwangseok CHOI *, Tomofumi MOGAMI **, Teruo SUZUKI **, and Mizuki YAMAGUMA*

Abstract:

This paper is a report of the relationship between the charge amount (charge to mass ratio) of polypropylene granules (PP; typical particle size of 2 to 3 mm, 300 kg) and the electrostatic discharges that happened while loading of metal silo (diameter, 1.5 m; straight body length, 3 m; capacity, 4.8 m³). The feedback control system was used in order to control the charge amount of PP granules. The electrostatic discharges inside the silo were also observed by using a conventional image-intensifier system. The results obtained from the experiments show that (1) two kinds of electrostatic discharges inside a metal silo while loading PP granules, i.e., brush discharges and incendiary bulk surface discharges were clearly observed. (2) the number of brush discharges and incendiary bulk surface discharges increased with the increase in the charge to mass ratio of PP granules, and then almost reaching saturation. And (3) brush discharges and incendiary bulk surface discharges began to happen at the $-1.16 \mu\text{C}/\text{kg}$ and $-2.33 \mu\text{C}/\text{kg}$ point, respectively in this study.

第 37 回 静電気学会全国大会アブストラクト集

Program number:

10pS-1

Title:

Revolution of Science education for fostering next generation

Affiliation:

Faculty of Education, CHIBA University

Author(s):

Jun NOMURA

Abstract:

In this era of globalization, one of the policies to sustain the continued development of Japan is to preserve the high level of our strength in science and technology. On the other hand, we are also faced with the problem of children losing interest in science. We have to reconsider how to teach them. For this reason, we in the Faculty of Education, which has a large responsibility for education in Japan, have established a system for nurturing a new generation of talented scientists. In this connection, last year we developed "Lab on the desk", a learning support program for children talented in science, led by university students. Furthermore, last year we implemented the TWINCLE program, which is aimed at training teachers who have both an understanding of cutting-edge science and a global point of view. Through these programs we aim to nurture highly talented scientists.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-1

Title:

Electrostatic-charge behavior of liquid in CFRP-fuel tank

Affiliation:

*The University of Tokyo , **Fuji Heavy Industries Ltd.

Author(s):

Akiko KUMADA*, Junki GOTO*, Hiroki NAKAMATA*, Kunihiko HIDAKA*, Hiroyuki
TSUBATA**, Ai KAWASHIMA**, Takayuki NISHI**

Abstract:

In recent years, carbon-fiber-reinforced plastic (CFRP) is widely used in various fields such as aircraft structures since it has high mechanical strength and lightweight characteristics. Although the aircraft fuel tank would be made from CFRP, the insulating coat on inner walls of the tank is still necessary to prevent electrolytic corrosions. However, the static electricity problem resides because of the special conductive characteristics of CFRP. To perform a rational design of a CFRP fuel tank, it is necessary to establish a method to check how high voltage is generated in the aircraft fuel tank. In this research, we grasp behavior of electric charge in mock liquid fuel in tanks by measuring the surface voltage on inner wall. In addition, the movement of charge is analyzed by the method of finite differences and the simulated results are compared with the measured results.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-2

Title:

Influence of Relative humidity on DC negative Corona discharge from a Fine Water Droplet

Affiliation:

Yamagata University

Author(s):

○Satoshi Sugimoto, Yoshio Higashiyama

Abstract:

Current waveform of corona discharge occurring at a cone tip of a water droplet consists of intermittent pulse groups with a regular interval due to formation and disruption of a Taylor cone. To investigate the influence of relative humidity on corona discharge from a water droplet, negative corona discharge was measured under the condition of relative humidity varying from 24% to 99%. Peak value and charge quantity of corona pulse trains were decreased with humidity. When relative humidity low, pulse height of corona pulse trains repeated at both the higher and lower level alternatively. This would result from temporal increase humidity near electrode due to the release of fine water jets.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-3

Title:

Multi-doped Nanocomposite Polymeric Insulating Material for Control of Treeing Deterioration

Affiliation:

Faculty of Education Chiba University

Author(s):

Yoshiaki Yamano

Abstract:

The nano-composite was prepared by mixed addition of azobenzoic compound and Al₂O₃ nano-particle into LDPE for the purpose of ensuring the electrical treeing resistance in a long term span. The compound used was 4'-hydroxyazobenzene-2-carboxylic acid (hc_Ab). Experimental results showed that tree initiation voltage for the mixed addition was increased to about 1.8 times higher than that for the base polymer (LDPE); An incubation time (a period from voltage application to tree generation) was almost 50 times longer than that for the base polymer. It was experimentally confirmed that absorption of electron's kinetic energy can be obtained by excitation of hc_Ab and cohesion of nano-particles can be controlled in the bulk of the nano-composite using hc_Ab.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-4

Title:

Resonant Vibrating Frequency of a Fine Water Droplet under AC Field

Affiliation:

Graduate School of Science and Engineering, Yamagata University

Author(s):

○Yoshio HIGASHIYAMA and Hajime WATANABE

Abstract:

Corona discharge from a fine water droplet always involves deformation of the droplet shape or Taylor-cone formation, emission of fine water jets or disruption of droplet. Therefore, corona discharge from a water droplet always manifests complicated aspects. In addition, disruption of Taylor cone simultaneously affects not only discharge current but also motion of water droplet. To confirm corona discharge phenomena from a water droplet, resonant vibrating frequency of a water droplet using with a volume of a few nL or a diameter with a few hundreds μm was measured under ac field. The water droplet was formed at a web string with a diameter of 20 μm by spraying deionized water toward it. Since the droplet has inherent resonant vibrating frequency defined by the size or volume, the size of the droplet was monitored by a microscope and resonant vibration or deformation was observed. The relationship between resonant vibrating frequency and the droplet size was expressed with inversely proportional -0.4 power of the volume.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-5

Title:

Electric Field Simulation of Water Tree Tip Using the Equivalent Circuit Model

Affiliation:

* Graduate School of Engineering and Resource Science, Akita University, ** Akita University

Author(s):

Kyohei Takahashi*, Masafumi Suzuki*, Noboru Yoshimura**

Abstract:

In this study, we calculated the electric field of water tree tip under high-frequency / low-frequency superposed voltages. It was found that the electric field of inside of water tree tip had been affected by high frequency of applied voltage. Whereas, the electric field of outside of water tree tip was affected by applied voltage waveform. Furthermore, it was revealed that the number of zero-crossings of electric field of outside of water tree tip was in the same number of that of applied voltage.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-1

Title:

Measurement of O and OH density distribution produced by an atmospheric-pressure helium plasma jet nearby rat skin

Affiliation:

The University of Tokyo

Author(s):

○Seiya YONEMORI, Ryo ONO

Abstract:

Atmospheric-pressure helium plasma jet is getting much attention because it enables plasma biomedical application such as sterilization and cancer treatment. In biomedical plasma applications, OH radical and O atom are deemed as a major factor in cancer treatment. In this study, O and OH density distribution and its temporal behavior nearby rat skin were measured to demonstrate actual biomedical application. Plasma discharge was under 6 kV, 10 kHz with 1.5 l/min of helium gas ow. Maximum OH density was approximately

1.5×10^{13} [cm⁻³] and maximum O density was approximately 5.0×10^{14} [cm⁻³] in the center of the plasma jet. We also measured time-evolution of OH and O density, resulting that OH and O density was almost constant between discharge pulses. And density distribution of both species varied depending on helium ow rate and water concentration on the surface. Those results suggest the production mechanisms and provision mechanisms of OH radical and O atom by an atmospheric-pressure helium plasma jet.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-2

Title:

Ozone removal using electric discharge

Affiliation:

Midori Anzen Co.,Ltd.

Author(s):

Tomoyuki Saito and Naoki Sugita

Abstract:

In the atmosphere, ozone is generated by corona discharge and non-thermal plasma applied to charging of particles, removal of VOCs, sterilization and others. It is necessary to remove the excess ozone after using for these processing because the odor threshold and TLV of ozone are very low. In this study, we have discovered the new discharge method which generates no ozone and removes ozone gradually with glow-like luminescence. It is presumed that the ozone removal mechanism is the reaction between ozone and nitric oxide (NO) which is generated by ozone removal discharge. It confirmed experimentally and theoretically that NO generated by the discharge reacts to ozone with the predicted reaction time. NO is safer than ozone and the applications of NO are expected to various fields in recent years.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-3

Title:

Effect of electrode gap distance for OH radical production in surface area

Affiliation:

National Institute of Advanced Industrial Science and Technology (AIST)

Author(s):

○Yoshiyuki Teramoto, Hyun-Ha Kim, Atsushi Ogata and Nobuaki Negishi

Abstract:

This paper focused on the effect of electrode gap distance (d) for OH radical production in the surface area. OH was measured in pulsed positive dielectric barrier discharge (DBD) under atmospheric pressure humid N₂ with several gap distances using laser-induced fluorescence (LIF) technique. DBD occurs in a point-to-plane gap (gap distance: $d = 0, 3.5, 5.5,$ and 8.5 mm) with a 1 mm-thick glass plate placed on the plane electrode. The ratio of OH production in the surface area (OHS) to OH total production (OHT) by a discharge pulse decreased with increasing gap distance, but kept constant when applied voltage rose. The energy efficiency of OHT had a peak within $0 < d < 3.5$ mm. On the other hand, that of OHS monotonically decreased with increasing d . The OH local density in the streamer channel was evaluated from decay rate of OH. The results indicated that OH local density in the surface area was almost the same as that near the anode tip. OH local density was scarcely affected by applied voltage and gap distance.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-4

Title:

Control of Irradiation Area of the Atmospheric Sheet-type Plasma Jet

Affiliation:

Faculty of Engineering, Nippon Bunri University

Author(s):

○Hiroshi MIZOGUCHI, Kota KAWANO, Yuto YANO, Keisuke YAMASHITA, Toshiyuki KAWASAKI and Miho SAKAI

Abstract:

An atmospheric pressure non-thermal plasma jet has been actively studied and developed for the sterilization and biomedical applications. In this study, the sterilization has been investigated using the sheet-type plasma jet generator. The control method of its irradiation area without changing the generator structure was investigated in order to apply in both the wide range and spot sterilization. The plasma jet generator used in this study consists of two glass plates, the H.V. electrode made onto one glass plate and the grounded electrode. The mixture gas of He and N₂ was supplied into the generator at a flow rate of 2 L/min. The sterilization of yeast was carried out. The irradiation area was evaluated by the clear zone size after the plasma irradiation and static culture in this paper. As a result, the width of plasma jet was decreased with increasing the N₂ concentration in He. Accordingly, the width of the clear zone was also decreased. It can be controlled by the applied voltage and N₂ concentration in He without changing the generator structure.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-5

Title:

Demonstration of Electrostatic pesticide spraying by Applying Triangular-Wave Voltage

Affiliation:

* Graduate School of Engineering, Tottori University, ** Arimitsu Industry Co., Ltd.

Author(s):

○ Hidetoshi TAKAYA*, Tatsuya IZUTSU*, Ryo NISHIMURA*, Takashi MASUOKA
, Toshihiro KIMURA, Shinji YATSUZUKA**, Shinobu ANAGUCHI**

Abstract:

In induction-charging electrostatic pesticide spraying (EPS), deposition properties of pesticide were improved by applying a triangular-wave voltage on an induction electrode rather than DC voltage. In this paper, we report on the results of pest-control experiments using potted pear trees and investigations of deposition properties in a greenhouse for pear-cultivation using a speed sprayer installing induction-charging electrodes near spraying nozzles. In the pest-control experiments, we sprayed a pesticide that controls rust to pear trees by using an induction-charging electrostatic sprayer applying DC and triangular voltages. It was shown that the numbers of rust lesions on the pear leaves can be decreased by 25% by applying triangular-wave voltage in comparison with the DC voltage. We also sprayed water by using a speed sprayer installing induction-charging electrodes near spraying nozzles in a greenhouse where pears were being cultivated on a trellis. Pieces of water-sensitive paper were fixed on the pear trellis to investigate the water-deposition properties. In this investigation, a clear difference in the deposition properties between triangular-voltage and DC voltage cases is not found. However, it is shown that adopting induction-charging system is effective for pest control using speed sprayers.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-6

Title:

Charge elimination model and evaluation of a closed-placed ionizer

Affiliation:

Yamagata University

Author(s):

○Kazutoshi FURUTCHI and Toshiyuki SUGIMOTO

Abstract:

DC ionizer placed closed to the charged target are proposed to shorten the charge elimination time. A charge elimination model that introduces a simplified charge elimination current is proposed to evaluate ionizer performance. The charge elimination model was verified by the experimental results. The closer the ionizer was located to the target, the higher the charge elimination current became.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-7

Title:

A Study on Fundamental Characteristics of Electro-Osmotic Pump

Affiliation:

Yamagata Univ

Author(s):

○Ryota ENDO Kyoko YATSUZUKA

Abstract:

An electroosmotic pump has some advantages over mechanical pumps in a simple structure, low cost, abrasion-free, light weight, easy-controlling and no-pulse-operation. Thus, there are several possibilities of the micro-pumps for a fuel-cell, bio-technology or thermo system in space. In this study, an electro-osmotic pump with a polymer filter in a pipette tip was examined and the fundamental pump characteristics are reported. The driving fluid is the water of 3.3 $\mu\text{S}/\text{cm}$ conductivity. The water column length grows with the applied voltage. The thinner filter is used, the higher on the direction of the applied voltage. If the water rises toward the same direction to that the water injected, the higher electroosmotic effect I obtained. It suggests that there is some electrification of water, when it inject into the pump system. There is also a very slow relaxation characteristics in rising the water column. More precise experiments will be necessary to clarify this dynamic behavior.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aA-8

Title:

Electrical Circuit of Frictional Electrification

Affiliation:

Tokyo University of Agriculture and Technology

Author(s):

Norio Murasaki

Abstract:

Charge generations of frictional electrification is controlled by the electronics states and their surface contact resistance of test pieces. The measuring systems of them are complicated in structures. On the circuit of frictional electrification, charge generation are controlled by the $e \cdot m \cdot f$ and contact surface resistance. The measurement systems of them are simple. Then, in electrical circuit of frictional electrification, electrification series are changed to stated mathematically charge quantity series and contact resistance series. And, frictional electrification in many types can be valuated mathematically as the charge state of figure of $e \cdot m \cdot f$ and resistance. Frictional electrification belong to electrical circuit.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-6

Title:

Improvement of piezoelectric properties of chiral polymer by using additives

Affiliation:

Graduate School of Engineering, Kansai University

Author(s):

Yoshiro TAJITSU

Abstract:

Improvement of piezoelectric properties of chiral polymer by using additives, Graduate School of Engineering, Kansai University, Osaka 564-8680, Japan, Yoshiro TAJITSU, By using additives to change the higher-order structure of a poly(L-lactide) (PLLA) PLLA film, an improvement in its piezoelectricity was realized. The additive used was a triblock copolymer, which is a pure acrylic symmetric block copolymer consisting of a center block of poly(butyl acrylate) (PBA), corresponding to its soft part, and two side blocks of poly(methyl methacrylate) (PMMA), corresponding to its hard part. The piezoelectric constant of the PLLA film after adding the triblock copolymer was over two times higher than that of the PLLA film without adding it (reference PLLA film).

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-7

Title:

The Effect of Discharge Polarity on Coaxial Cylinder Dielectric Barrier Discharge in humid nitrogen atmosphere

Affiliation:

Mitsubishi Electric Corp.

Author(s):

Yusuke Nakagawa

Abstract:

In order to solve air pollution problem, atmospheric plasma application is desirable. In this study, we investigated the effect of discharge polarity on coaxial cylinder pulsed barrier discharge in humid N₂. Laser-induced fluorescence measurement indicated that OH production is about 30 ppm at 3 μs after discharge when +28 kV is applied. As for the negative discharge, OH measurement revealed that OH production is almost the same but OH density is about one fourth compared to those in positive discharge, due to the difference in streamer radius. Humidity effect on TCE decomposition efficiency in N₂ pulsed barrier discharge is also investigated using the same reactor. The increasing humidity resulted in enhancement of TCE decomposition efficiency, indicating that OH plays important role in TCE decomposition. Besides, TCE decomposition efficiency in negative discharge is larger than in positive one. It can be explained considering the OH density dependence on discharge polarity.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-8

Title:

Development of Ion Adsorption Capability Electrodes for Electrokinetic Phenomenon

Affiliation:

* Graduate School of Engineering and Resource Science, Akita University

Author(s):

○Koutarou Takahashi*, Mahmudul Kabil*, Masafumi Suzuki*

Abstract:

With the development of the industries, the pollution of the soil by heavy metal from industrial effluents has become serious problems to the environment. Therefore, many techniques were proposed for the process of the contaminated soil. Recently, electrokinetic phenomenon is being noticed. In this method, ionized heavy metal which is included for contaminated soil moves to cathode side with the water by the electroendosmosis and discharged from soil. However, this method may link to a secondary pollution through the drainage. Electrodes made of ion adsorption materials may help to solve this problem. We have chosen zeolite and activated carbon as ion adsorption materials and prepared electrode. These electrodes are used as cathode thus can adsorb heavy metal ions from the drainage. In this research, we have prepared two types of electrodes with different materials (i.e. activated carbon, zeolite) and measured their properties. The ion adsorption capability of these electrodes were measured with standard solution of copper. The recovery of copper was 12 % for activated carbon electrode, and 26 % for zeolite electrode including carbon powders. So, these electrodes have good possibility to remove heavy metals from the contaminated soil.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-9

Title:

A Mechanism of Triboelectric Charging of Powdered Polymers in Vacuum at 77 K

Affiliation:

* Institute of Environmental Sciences, University of Shizuoka, **

Department of Agriculture, Meijo University, *** Graduate School of Agriculture and Life Sciences, The University of Tokyo

Author(s):

○Masato SAKAGUCHI *, Masakazu MAKINO *、 Takeshi OHURA ** and Tadahisa IWATA ***

Abstract:

The frictional contact between two polymeric materials should produce scissions of chemical bond comprising the polymer main chain.

Accordingly, we set the mechanical fracture of polymers in vacuum at 77 K by a ball milling. Under the condition, the mechano-radicals, mechano-anions, and mechano-cations were produced by homogeneous and heterogeneous scissions of the carbon-carbon bond comprising polymer main chain. They were trapped on the fresh surface of powdered polymers produced by the fracture, and did not decay out at 77K in vacuum. We calculated the HOMO and LUMO energy levels of mechano-radicals, mechano-anions and mechano-cations for PP, PE, PVF, PVDF, PVC, BC and PTFE in vacuum based on their model structures using Gaussian R 09W (ver. 7.0) and GaussView ver.5.0. Each sign of charge due to friction between polymers was estimated by counting the electron transfer reactions among mechano-radicals, mechano-anions, and mechano-cations that the reactions controlled by their HOMO and LOMO energy levels. According to our proposed mechanism for the triboelectric charging of polymers in vacuum at 77 K, polymers can be ordered as follows: Positive, PP-PE-PVC-PVF=PVDF-BC-PTFE, Negative. This result strongly suggests that the relative sign of the charges of polymers in vacuum at 77 K can be estimated by their chemical structure.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-10

Title:

Negative Pulsed Breakdown Phenomena in Supercritical Carbon Dioxide

Affiliation:

Graduate School of Science and Technology, Kumamoto University, Japan* Institute of Pulsed Power Science, Kumamoto University, Japan** Multidiscipline laboratory of Kyusyu Electric Power Co., Inc., Japan***

Author(s):

○Tomohiro Furusato*, Hiroyuki Tanoue*, Sunao Katsuki**, Masanori Hara***, Hidenori Akiyama*

Abstract:

Discharge phenomena in supercritical fluids (SCFs) have begun to catch the attention of many research fields due to their attractive characteristics. However, specific studies of discharge mechanism in SCFs remain scarce. So far, the authors studied initiation mechanism of nanosecond pulsed discharge in supercritical carbon dioxide at gap distance of few mm under positive and negative polarity. Although a negative pulsed voltage with a peak voltage of 50 kV and half-width of 410 ns was applied to the 1 mm gap, streamer growth was limited to within a quite narrow region. In this study, the negative pulsed breakdown phenomena in supercritical carbon dioxide with a 100 μm needle gap distance were reported. The pre- and post- breakdown phenomena in supercritical phase were visualized by means of Shadowgraph method. The tip curvature of the needle was set at $r = 8$ and $490 \mu\text{m}$. The appearance of streamer at pre-breakdown varied greatly by changing the needle tip curvature, although the breakdown voltage, approximately 60 kV, remained somewhat constant. A large bush like streamer and several individual small bush like streamers grew from the cathode at $r = 8$ and $490 \mu\text{m}$.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pA-11

Title:

Dielectric Breakdown and Mechanical Properties of Polylactic Acid Spherulites of Different Sizes

Affiliation:

Hachinohe Institute of Technology

Author(s):

○Naru MATSUGASAKI、Katsuyoshi SHINYAMA、Shigetaka FUJITA

Abstract:

The degree of crystallinity of polylactic acid (PLA) was increased by heat treatment, and the dielectric breakdown strength and mechanical properties of the obtained PLA of different spherulite sizes were studied. PLA heat-treated at a temperature of 120°C or higher showed rapid increases in spherulite size. At both measurement temperatures of 25°C and 80°C, the dielectric breakdown strength (EB) showed rapid falls when the heat treatment temperature was 120°C or higher. At a measurement temperature of 25°C, the tensile strength at break and breaking elongation showed rapid falls when the heat treatment temperature was 120°C or higher.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-1

Title:

Decomposition of CF₄ in DC Plasma within Bubble and Trapping Fluorine

Affiliation:

- * Department of Electrical and Electronic Engineering, Tokyo Institute of Technology
- ** Taiyo Nippon Sanso Corporation

Author(s):

○Yuriko MATSUYA *, Ryota SUGANUMA *, Koichi YASUOKA * and Katsumasa SUZUKI **

Abstract:

Perfluorocarbons (PFCs) such as tetrafluoromethane (CF₄) are widely used in semiconductor manufacturing processes; however, there is urgent need to reduce the PFCs emissions due to their large global warming potential. DC plasma within gas bubbles, which were generated in tap water, was used for PFCs decomposition. The detached fluorine atoms from CF₄ were captured in the water and their concentration was measured and used for calculating the CF₄ removal rate. The CF₄ removal rate increased with decreasing the gas flow rate and increasing the current. The maximum CF₄ removal rate of 96.7% was obtained at an applied current of 13 mA.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-2

Title:

Removal of Ethylene and By-products Using Packed Bed Dielectric Barrier Discharge with Ag Supported Catalyst

Affiliation:

Faculty of Engineering, Iwate University

Author(s):

Tomoya Kawamura

Abstract:

Ethylene was decomposed using packed-bed type dielectric barrier discharge (PBDBD) plasma reactor to keep freshness of fruits. The PBDBD plasma was generated by a pulse switching power supply which consisted of MOS-FET switching devices, capacitors and pulse transformers. Ag supported catalyst having high catalyst activity and having the performance which oxidizes reduction and carbon monoxide of ozone near room temperature has been reported. The experimental results showed that the ethylene removal was increased by employing Ag supported catalyst pellets. The ozone generation and carbon monoxide generation was reduced by employing Ag supported catalyst pellets. The PBDBD with Ag supported catalyst was reduced ethylene, ozone and carbon monoxide. Carbon monoxide was confirmed to oxidize to carbon dioxide with Ag supported catalyst by Fourier Transform Infrared Spectroscopy spectra.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-3

Title:

Electrostatic Precipitator Utilizing Gradient-force

Affiliation:

*Panasonic Environmental Systems & Engineering Co., Ltd, **Panasonic Ecology Systems Co., Ltd, ***Toyohashi University of Technology

Author(s):

○Atsushi KATATANI *, Hiroshi HOSONO **, Hikaru MURATA **, Hiroshi YAHATA *
*, and Akira MIZUNO ***
MURATA **, Hiroshi YAHATA **, and Akira MIZUNO ***

Abstract:

ESPs (electrostatic precipitators) charge particles which are passing through corona-discharge space and collect them by Coulomb's force. The purpose of this study is to charge particles without using corona-discharge and collect them.

i.e. Due to Gradient force, the particles which enter the non-uniform electric field attach onto the parts of electrodes whose electric field is stronger. This study clarifies that the attached particles possess electrical-charge after re-entrainment. This means that particles can be collected by Coulomb's force, utilizing at first "temporary collection by Gradient force", and then, "re-entrainment" even under the condition without corona-discharge current. The possibility of drastic reduction of the power consumption in ESPs has been found.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-4

Title:

Enhancement of collection efficiency for diesel particulate matter using collection plate with electrostatic flocking in an Electrostatic precipitators

Affiliation:

Department of Environmental and Life Sciences, Toyohashi University of Technology *

Author(s):

○Yuri Kawara, Hirofumi Kurita, Kazunori Takashima and Akira Mizuno

Abstract:

Diesel particulate matter (PM) exhausted from diesel engine causes environmental pollution. Many methods have been applied for removal of PM. Electrostatic precipitators (ESPs) can collect nanosized particles at low pressure drop. However, a problem with ESP is dust re-entrainment. The agglomerated particles repeat bouncing and are emitted from ESP. In this study, electrostatic flocking on a collecting electrode was applied to suppress the re-entrainment. The electrostatic flocking slightly improved total collection efficiency. Especially, particles approximately 50 nm in diameter were collected more effectively than normal ESP while smaller particles at around 10 nm was better collected by normal ESP.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-5

Title:

Influence of Solution Flow Rate on Degradation of LAS in Air-Liquid Interface Discharge

Affiliation:

Department of Electrical and Electronic Engineering, Oita University

Author(s):

○ Tomokazu OKAWA, Takaaki AJIMURA, Shuichi AKAMINE, Ryuta ICHIKI, Seiji KANAZAWA

Abstract:

The degradation of linear alkylbenzenesulfonate sodium (LAS) was performed in air-liquid interface discharge using a cylindrical reactor. The dielectric barrier discharge was generated between the threaded rod electrode and running water film on the wall of the reactor. The influence of the solution flow rate on the degradation of LAS was investigated. LAS concentration was measured by high performance liquid chromatography (HPLC) with fluorescence detection. As a result, a difference of the degradation rate was observed in an early treatment stage. And then, the degradation rate was gradually increased up to 100 % as the treatment time elapsed.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-6

Title:

Decomposition of Mixed Solution of Dichloromethane and Sodium Formate by Discharge Inside Bubble in Water

Affiliation:

* Faculty of Engineering, Iwate University, ** Shishido Electrostatic, LTD., *** Faculty of Agriculture, Iwate University

Author(s):

○ Keita WADA *, Shuta KAWANO *, Katsuyuki TAKAHASHI **, Koichi TAKAKI * and Naoya SATTA ***

Abstract:

Water purification by discharge inside bubble in water containing two organic compounds has been investigated. Dichloromethane (DCM) and sodium formate were employed as specimens to evaluate decomposition efficiency. Argon or oxygen gases were injected into the water near the high-voltage wire electrode to generate plasma to identify the dominant reactions of the decomposition of the organic compounds solutions. The DCM was decomposed successfully by injecting argon gas. In contrast, sodium formate was decomposed by injecting oxygen gas. When each gas was injected, in the amount of decomposition of DCM, there was little difference between solution of DCM alone and the solution mixed with sodium formate. On the other hand, the decomposition efficiency sodium formate decreased in the mixed solution in comparison with that in the sodium formate solution. These results indicate that the DCM addition into the sodium formate solution did not affect decomposition efficiency of sodium formate under the experimental condition.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10aB-7

Title:

NO_x Removal for Flue Gas in Glass Furnace Using a Plasma and Chemical Hybrid Process - Laboratory experiments with semi-dry model system -

Affiliation:

*Department of Mechanical Engineering, Osaka Prefecture University, **Nihon Yamamura Glass Co.,Ltd.

Author(s):

Tomoyuki KUROKI*, ○Hashira YAMAMOTO**, Hidekatsu FUJISHIMA*, Daichi TAKADA*, Yuusuke YAMATO* and Masaaki OKUBO*

Abstract:

In order to develop a new NO_x and SO_x simultaneous removal technology for flue gas in glass furnaces, a plasma and chemical hybrid process is employed and laboratory-scale experiments are carried as a model study. It is clarified that it is necessary to cool the exhaust gas temperature less than 100 °C in order to obtain a high efficiency in the oxidation of NO to NO₂ with ozone. The effects of water spray, the ozone injection amount, and the reducing agent solution (Na₂SO₃) concentration for the simulated high temperature exhaust gas are investigated. As a result, de-NO_x performance is maintained stable during 120 min experiment, and NO outlet concentration is reduced to 11 ppm from 100 ppm, with total NO_x outlet concentration of 39 ppm. In the range of treated exhaust gas temperature, stable performance for NO_x removal by the plasma-chemical reactions is obtained. It is confirmed that the application of the plasma-chemical hybrid process to existing glass furnace with semi-dry-type de-SO_x equipment is very effective.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-1

Title:

Investigation of Organic Compound Decomposition and Microbial Inactivation by a Cylinder Style Pulsed Discharge System in High Conductivity Solution

Affiliation:

Graduated School of Engineering, Gunma University

Author(s):

Takanori TANINO, Yukihiro TAMURA and ○Takayuki OHSHIMA

Abstract:

A cylinder style discharge system was applied for organic compound decomposition in high conductivity solution. Effect of the submerging electrode and treatment water conductivity on the degradation of the organic compound by pulsed discharge plasma was investigated by using indigocarmine and oxalic acid. Submerging electrode sheathed with gas flow in the treatment water facilitated decomposition of these organic compounds. It was demonstrated that decomposition ratios of organic compound in the high conductivity solutions, that were equivalent to saline (18 mS/cm) and seawater (51 mS/cm) respectively, were higher than that in the deionized water. And the reachable decomposition ratio was also increased in the adjusted high conductivity solutions. Moreover, application of this system for microbial inactivation was investigated. Similar to the results in the organic compound decomposition, efficient inactivation was also detected in high conductivity solution.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-2

Title:

Lean NOx Purification using Catalytic Reaction Assisted by Plasma

Affiliation:

Nissan Motors*, Waseda University**

Author(s):

○ Masato Nagata*,**, Yasunari Hanaki*, Katsuo Suga*, Atsushi Ikeda**, Yasushi Sekine**

Abstract:

Catalytic reaction assisted by plasma is proposed as a novel reaction system for low temperature NOx removal. NOx decomposition reaction was promoted by the plasma-catalyst system even at low temperature. The depression of performance by gaseous oxygen was a large issue in the plasma-catalyst combined system in diesel exhaust condition. Pt and SiO₂ showed superior performance as a catalyst material in the plasma.

Electrical property of the catalyst material was investigated, and we found a correlation between maximum peak currents and catalytic activity.

Further investigations using diesel exhaust gas will enable an effective NOx removal system even at low temperature.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-3

Title:

Diesel Exhaust Treatment by Multistage Honeycomb Discharge Reactor

Affiliation:

Department of Environmental and Life Sciences, Toyohashi University of Technology *

Author(s):

○Yuichi HINATA, Tomoya SUZUKI, Hideaki HAYASHI, Hirofumi KURITA, Kazunori TAKASHIMA and Akira MIZUNO

Abstract:

A selective catalytic reduction using urea as reducing agent (Urea-SCR), has been investigated and has been a well-established technique for DeNO_x of stationary NO_x emission sources. However, SCR catalysts do not work at lower temperature region less than ca.180°C, and this is a problem when SCR is to be applied for vehicle emission control. Atmospheric pressure non-thermal discharge plasma can be used complementally to assist catalytic activity at low temperatures. We have developed a method to generate homogeneous discharge inside a honeycomb catalyst. In this paper, the SCR catalyst was hybridized with the discharge in honeycomb to improve the catalytic activity at low temperatures. As a result, deNO_x efficiency for the simulated diesel exhaust could be improved from ca.20% to 73% at 140°C.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-4

Title:

Spectrometry of plasma-assisted combustion by reforming fuel

Affiliation:

Graduate school of Frontier Sciences, The University of Tokyo

Author(s):

Soichi Kobayashi, Ryo Ono, Yoshiyuki Teramoto

Abstract:

This paper focused on the effect of plasma assist for flame temperature and OH radical density in the flame. The dielectric barrier discharge (DBD) was used for propane reforming. The flame temperature and OH radical with and without plasma assist were measured using emission spectroscopy and laser-induced fluorescence (LIF). The OH density in under part of flame was increased up to approximately 2 times by the plasma assist. However, such increase could not be observed in upper and middle part. The results of flame temperature measurement showed that the temperature in under part of flame rose by 270 K with plasma-assist, and LIF method was suitable for the temperature measurement in plasma-assisted flame.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-5

Title:

Removal of cesium ion in water using combination of zeolite and AC electric field application

Affiliation:

Dept. Environmental and Life Sciences, Toyohashi University of Technology

Author(s):

Yuki TAINO, Takuma SUGANO Hirofumi KURITA, Hachiro YASUDA, Kazunori TAKASHIMA, and Akira MIZUNO

Abstract:

^{137}Cs is one of the most dangerous radioactive materials due to its long half-life period of approximately 30 years. Efficient and high throughput treatment (removal) of the cesium ions in water is therefore required. We tried to remove cesium ions rapidly by applying pulsed high voltage to zeolite. Since cesium ions are positively charged, they are driven by the electric field. In order to restrict overcurrent, pulsed high voltage was applied to the reactor packed with the zeolite pellets. The result indicated that the removal efficiency of Cs ions was almost twice higher compared with that without voltage. It should also be noted that total amount of absorbed Cs ions with the voltage application can also be increased. These results suggest that this method is effective for removal of Cs ions in water.

第 37 回静電気学会全国大会アブストラクト集

Program number:

10pB-6

Title:

Catalytic Property of Platinum Nanoparticle Films Using A Few
Tens keV Electron Beam Induced Reduction Method

Affiliation:

* Japan Atomic Energy Agency * * Saitama Institute of Technology

Author(s):

○ Teruyuki HAKODA * , Shunya YAMAMOTO * , Iwao SHIMOYAMA * , Hirofumi
ARITANI * * , and Masahito YOSHIKAWA *

Abstract:

We previously observed that platinum nanoparticles films was produced on the surface of a solution containing 1 mmol/L PtCl₄²⁻ ions and 0.5-20v% ethanol by irradiating with a few tens keV electron beams (EB). In the present study, the platinum films were deposited to tungsten trioxide (WO₃) films, ch show hydrogen gasochromic property, to examine the catalytic property of the platinum films. The transmittance of 700-nm lights through the repared (Pt/WO₃) films decreased in exposing to 1v% hydrogen/nitrogen gas. This decrease suggests the production of HxWO₃ films through the reaction of WO₃ films with hydrogen atoms dissociated over Pt nanoparticles. The Pt nanoparticle films prepared using a few tens keV EB induced reduction method were observed to have catalytic activity.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-1

Title:

Evaluation of Potential of p-Nitrophenol Degradation in Over-Wet Soil by Pulsed Corona Discharge Plasma

Affiliation:

*Institute of Electrostatics and Special Power, Dalian University of Technology, Dalian, 116024, China **East China Sea Fisheries Research Institute, Chinese Academy of Fisheries Sciences, Shanghai, 200090, China

Author(s):

○Na LU*, Kefeng SHANG*, Cuihua WANG**, Xue ZHANG*, Jie LI*, Yan WU*

Abstract:

An experimental investigation of p-Nitrophenol (PNP) degradation was conducted with a view toward evaluating the potential of remediating over-wet soil by pulsed corona discharge plasma. Experimental results showed that PNP could be smoothly removed from over-wet soil. PNP degradation efficiencies were found to be influenced by different plasmas, which were 88.5% and 65% under oxygen and air atmospheres after 30 min of discharge treatment, respectively. Maximum PNP degradation efficiency as well as kinetic constant was obtained at air flow rate of 0.8 L min⁻¹. Great COD removal was obtained and the mineralization was confirmed by TOC analysis. This study is expected to provide reference for the application of pulsed corona discharge plasma in removing organic pollutants from over-wet soil.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-2

Title:

The characteristics of shock-wave generated by discharge in liquid

Affiliation:

Environmental Science and Engineering College, Dalian Maritime University, Dalian
116026, China

Author(s):

B. Sun*, Z. Gao, X. Zhu, B. Wang and Z. Yan

Abstract:

In this paper, the characteristic of shock-wave generated by pulse discharge in liquid were studied with rod-rod electrodes. The characteristics of shock wave with change of the pulse voltage and electrode gap were studied in the discharge process. The results show that the peak pressure of shock wave increased with the increasing of pulsed voltage. The peak pressure of shock wave increased first and then decreased with the increasing of electrode gap when the discharge voltage is 22kV. The pressure of the shock wave (P_r) decays exponentially with the distance (r) from the discharging center. Under this experimental condition, the shock wave intensity is calculated by averaging values of the experiment, and the experience formula is given for $P_r = 2.56E \cdot e^{-0.4831r}$.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-3

Title:

Plasma–water interaction for removal of persistent substances in water

Affiliation:

Department of Electrical and Electronic Engineering, Tokyo Institute of Technology

Author(s):

K. Yasuoka, Y. Matsuya, R. Sukanuma, and N. Takeuchi

Abstract:

Discharge plasmas generated at gas–liquid interfaces are extensively studied for water purification. There are two methods for water purification: (a) using oxygen radicals generated by the plasma at the interface and (b) the direct decomposition of substances by the plasma. The key parameters in the use of radicals are summarized in the case of acetic acid decomposition; that is, current density, solution conductivity, and water vapor concentration. In perfluorooctanesulfonic acid (PFOS) decomposition, the abovementioned parameters did not affect the decomposition process. The deposited energy in the discharge, the accumulation of PFOS at the interface, and the polarity of the applied voltage were much more important.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-4

Title:

Investigation on Degradation of Coking Wastewater by Gas Phase
Surface Discharge Plasma Using Liquid Electrode Combined with Catalysts

Affiliation:

Institute of Electrostatics and Special Power, Dalian University of Technology, Dalian,
China

Author(s):

○ Jie LI, Lijuan DUAN, Kefeng SHANG, Na LU, Yan WU

Abstract:

A gas phase surface discharge plasma system employing wastewater as one of the electrodes was applied to the degradation of coking wastewater. The main advantage of this system is that reactive species like ozone produced by the DBD can be utilized for the treatment of wastewater. This system was able to remove coking wastewater effectively, at an initial pH of about 8.5, air flow rate of 1.6 L/min and initial COD concentration of 160 mg/L with applied voltage 7 kV and frequency 7 kHz, the COD degradation efficiency reached 51.6% with 60 min. Meanwhile, this paper investigated the oxidation performance of coking wastewater combined with Fe²⁺ and MnO₂ catalysts. Their COD removal rates were investigated. In the presence of Fe²⁺ (0.02 mol/L), the COD degradation efficiency was accelerated due to the generation of oxidizing hydroxyl radical ($\cdot\text{OH}$), the COD degradation efficiency reached 70.1% with 60 min, but the COD degradation efficiency decreased with the high concentration of Fe²⁺. The results also indicated that MnO₂ catalysts could improve the removal of COD especially in acid solutions, the COD degradation efficiency reached 62.6% with 60 min at initial pH=1.8, and the dosage of MnO₂ had less effect on it in this process.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-5

Title:

A Novel Synthesis Technology of Size-Controllable Nano Metal Particle: Solution Plasma Processing

Affiliation:

Green Mobility Collaborative Research Center, Nagoya University

**Materials, Physics and Energy Engineering, Nagoya University

***Department of Materials Science and Engineering, Nagoya University

****Graduate School of Engineering, Nagoya University

Author(s):

Oi Lun Helena LIO*, **, ***, ****, Kuniko URASHIMA*, **, ***, ****

Abstract:

Structure-controlled metal nanoparticles (MNPs) were successfully synthesized by an innovative plasma in liquid method, termed solution plasma processing (SPP).

SPP belongs to a non-equilibrium plasma process which occurred with a discharge voltage, current and frequency, respectively, in the range of 1 kV, 1 A and 103 Hz.

The process offers a new reaction medium, where the active species and chemical reactions can be altered by varying the liquid media. There are two different routes to prepare various types of MNPs:

(1) reduction of metal ion to pure metal, (2) sputtering directly from electrode. In this study, gold and platinum MNPs synthesized by the above methods will be discussed separately.

By varying the plasma parameters such as discharge duration, applying voltage and electrode distance, the size of MNPs can be precisely controlled from few nm to several tens of nm.

In general, the size of MNPs synthesized from electrode sputtering ranged below 10 nm, where the diameter of MNPs generated by metallic ion reduction was observed between 10 - 30 nm.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-6

Title:

High-speed camera visualization of electrospray of water

Affiliation:

1Department of Environmental Management Technology, AIST

2Department of Astronomy, Earth Physics and Meteorology, Comenius University

Author(s):

H.H. Kim¹, B. Pongrac², Y. Teramoto¹, N. Negishi¹, Z. Machala², A. Ogata¹

Abstract:

This paper presents the time-resolved imaging of EHD spray of water with different conductivities for negative and positive DC voltage. Dripping mode, which was the first mode of EHD spray, occurred in the same pattern regardless of the water and polarity of voltage. The most important factor determining the size of droplet is spray pattern just before the break-up into droplets. Break-up of long water filaments produced droplets having similar size of the diameter of parent filament. The time-resolved images provided some information on the different elongation pattern according to the polarity. The rotating and stable cone-jet were only observed with positive EHD spray of deionized water. The vigorous lashing and swirling movement of water filament also determine the spray angle and the size of final droplets. On the other hand, negative EHD spray of tap water occurs only in dripping mode.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-7

Title:

Study on LiNbO₃ as Dielectric Barrier Discharge: Its Electrical Properties and Electrical Wind Generation

Affiliation:

Applied Electrostatic Laboratory, Dept. of Environmental and Life Sciences, Toyohashi University of Technology,

Author(s):

Rayendra ANANDIKA, Kazunori TAKASHIMA, Akira MIZUNO

Abstract:

In this study, LiNbO₃, an important ferroelectric material, has been used as a barrier for the dielectric barrier discharge, DBD. The response of the barrier against the alternative applied voltages has been experimentally studied. The saw-tooth voltage waveform gives a distinct response of the consumed electrical power because of the hysteretic relationship between polarization and electrical field. The 0% slope angle or negative sawtooth voltage waveform consumed the higher electric power than the other slope angles. Temperature of the barrier and profile of the electrical wind generated in this configuration are also measured to study the influence of the voltage waveform.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aIS-8

Title:

The Non-Thermal Plasma Combined with Catalyst of Active Carbon Based on Coal for Removal of NO_x

Affiliation:

1Department of Environmental and Life Sciences, Toyohashi University of Technology, Japan 2 Anhui University of Science and Technology, China

Author(s):

M. Chen^{1, 2}, K. Takashima¹, and A. Mizuno¹

Abstract:

Abstract — The Non-Thermal Plasma (NTP) combined with catalyst is one of effective way to remove NO_x from the automobile exhaust gas. In this paper the Catalyst of Active Carbon of based on Coal (CACC) was prepared and evaluated the performances to remove NO_x in the DBD reactor. The metal of Copper and Zinc was deposited on the surface of CACC and used as the active points. The ion of NO₃⁻ was detected in the leaching solution of after used CACC by the Nitrate Ion Detector. According to the ion of NO₃⁻ and PH value of the leaching solution, it can conclude that the NO is absorbed in the CACC surface firstly and then oxidized to NO₂ and more oxidized and changed to NO₃⁻. At the reaction of the CACC combined with the NTP, the concentration of NO and NO_x reduces down fast at first and then reaches to stable value nearly after 3 min. It shows the main contribution of removal of NO and NO_x is adsorption at first in 3 min. The concentration of NO and NO_x decreases with the increasing of input power. The NO and NO_x removal rate at the CACC combined with the NTP condition is bigger than at the glass bead combined with the NTP condition. Key Words —Non-Thermal Plasma; Dielectric Barrier Discharge; NO_x removal rate, Catalyst of Active Carbon of based on Coal

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pS-1

Title:

Early Underwater Pulsed High Voltage Discharge Studies with Masayuki Sato
and Recent Electrostatic Projects at NASA/KSC

Affiliation:

Department of Physics and Astronomy, Appalachian State Univ.

Author(s):

Sid CLEMENTS

Abstract:

In 1985, Sato and Clements investigated prebreakdown phenomena in water for point-plane geometries using high-voltage pulses. Spot discharges, filamentary magenta streamers, isolated microdischarges, and microbubbles were observed and photographed. Emission spectra were obtained using a prism spectrograph. Maximum streamer lengths were determined as a function of applied voltage, pulsewidth (decay constant), and water conductivity. The bubbling of gas through the underwater discharge resulted in the disintegration of the gas bubbles, and also caused gas-phase discharges to occur near the nozzle electrode. The production of ozone when bubbling oxygen gas through a discharge in deionized water was investigated by photometrically measuring the decolorization of anthraquinone dye. In 2003, Clements began collaborating with the Electrostatics and Surface Physics lab at NASA/KSC working on numerous NASA electrostatic issues such as Space Shuttle explosion hazards, ESD prevention for the Hubble telescope repair mission, and precipitation static issues on the new Aries rocket. In addition, several electrostatic projects are in progress relating to exploration of the Moon and Mars. An electrostatic precipitator is being developed for Martian In-Situ Resource Utilization oxygen concentrators, as well as an instrument for measuring the size and charge of individual dust particles on Mars. Paschen gas breakdown tests have been conducted for a simulated Martian atmosphere. In addition, an electrodynamic screen is being developed for removing dust from Martian and Lunar rover solar panels, space suits and visors, viewports, habitats, and radiators.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pIS-1

Title:

PM removal of an electrostatic filtration device combined with a metallic foam filter under high velocity and temperature conditions for large volumetric diesel engines

Affiliation:

* Environmental and Energy Systems Research Division, Korea Institute of Machinery and Materials (KIMM) * * Department of Electrical Engineering and Information Systems School of Engineering, the University of Tokyo

Author(s):

Hak-Joon Kim * , * * , Bangwoo Han * , Yong-Jin Kim * , Hong Suk Kim * , and Tetsuji Oda * *

Abstract:

An electrostatic diesel particulate matter filtration device has been tested using 4000 cc diesel engines operating at standard (European Stationary Cycle (ESC) 13 mode) conditions when temperature changed from 300 to 500°C and normal gas flow rate from 2 to 8 m³/min. The device consisted of an electrostatic precipitator with edge to cylinder type and a metallic foam filter. To minimize the volume of the foam filter and reduce pressure drop through the filtration device, the layer of a foam filter was reduced from 20 to 6 layers. PM emission of the newly developed filtration device with 6 layers of foam sheets was 0.011 g/kWh which was much less than PM regulation of EURO 5 (0.02 g/kWh), while the emission of the foam filter made with 20 layers was 0.0235 g/kWh. In particular, the pressure drop of the device with 6 layers of foam sheets was only 20% of that with 20 layers.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pIS-2

Title:

Ferrous Sulfate Enhances Bleaching Effect of Organic Dye Solution by Cold Plasma Jet

Affiliation:

Department of Environmental and Life Sciences, Toyohashi University of Technology

Author(s):

○Tomoko NAKAJIMA, Hachiro YASUDA, Hirofumi KURITA, Kazunori TAKASIMA and Akira MIZUNO

Abstract:

Enhancement of bleaching effect of cold plasma jet in aqueous organic dye solution by combination use with ferrous sulfate has been tried. In presence of ferrous iron, a catalytic reaction which converts hydrogen peroxide to a highly reactive hydroxyl radical can be induced (Fenton reaction). Indigo carmine and ferrous sulfate were used as organic dye and ferrous iron source, respectively. Indigo carmine solution (400 mg/l) with various concentration of ferrous sulfate were exposed to plasma jet for 3 minutes, and the degradation of dye was evaluated by optical density at 595 nm (OD₅₉₅), without exposure and 1 to 24.0 minutes after the exposure. In result, enhancement of bleaching effect was achieved by presence of 0.01, 0.1 and 1.0 mM ferrous sulfate during plasma exposure. Additionally, further bleaching after exposure was observed in 0.01 and 0.1 mM ferrous sulfate. 0.1 mM sulfuric acid during plasma exposure and addition of 0.1 mM ferrous sulfate after exposure did not reproduce the synergetic residual effect. It can be expected that proper ferrous sulfate addition enhances both intensity and durability of degradation effect by atmospheric pressure low-temperature plasma.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pIS-3

Title:

Effects of Reactor Configuration on Benzene Removal via Hybrid Surface/Packed-Bed Discharge Plasmas

Affiliation:

Institutes of Electrostatics and Special Power, Dalian University of Technology, Dalian, China

Author(s):

Yan WU, Nan JIANG, O Na LU, Kengfeng SHANG, Jie LI

Abstract:

The effects of reactor configuration on the plasma removal of benzene in air were systematically studied in a hybrid surface/packed-bed discharge plasmas reactor. In this study, the removal efficiency of benzene and energy yield were compared for different high-voltage electrode (coil electrode) diameters from 0.5 to 1.4, different coil pitches of high-voltage electrode in the range of 2-9 mm and different dielectric barrier (quartz tube) diameters in the range of 14-22 mm. The experimental results demonstrated that the benzene removal efficiency enhanced with increasing specific energy density (SED) distinctly, while energy yield decreased simultaneously. The coil electrode with a diameter of 1 mm and a pitch of 7.5 mm appeared to be more advantageous with respect to both benzene degradation and energy yield. In addition, benzene removal was strongly dependent on the size of quartz tube, the smaller size (14 mm) quartz tube exhibited remarkable better removal and energy performance than the bigger size (22 mm) one.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pIS-4

Title:

High cleaner air delivery rate performance of an two-stage ESP air cleaner for Indoor Air Quality with negligible ozone emission by carbon fiber ionizers

Affiliation:

* Environmental and Energy Systems Research Division, Korea Institute of Machinery and Materials (KIMM) * * Department of Electrical Engineering and Information Systems School of Engineering, the University of Tokyo

Author(s):

Hak-Joon Kim * , * * , Bangwoo Han * , Yong-Jin Kim * , and Tetsuji Oda * *

Abstract:

A novel ESP type air cleaner with positive polarity was developed using an ionization stage with 16 carbon fiber ionizers in each channel, and a collection stage with parallel metallic plates. Its clean air delivery rate was measured by Korean standard test method using 0.3 μ m KCl particles, changing applied voltages and flow rates of the air cleaner. The experimental results showed that its CADRs were changed from 7.9 to 12.1 m³/min when applied voltage to ionizers (6 to 8 kV) and collection plates (-5 to -7 kV), and flow rate (10 to 20 m³/min) were varied. In particular, the air cleaner achieved a CADR of 12.1 m³/min with applied voltage of 8 kV to the ionization stage, and of - 6kV to the collection stage at 18 m³/min, while emitting significant low ozone with a maximum value of 5.4 ppb for over 12 hours of continuous operation.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pIS-5

Title:

A novel & simple synthesis method for generating nanocarbon-supported metal nanoparticle for air cathode of Li/Air battery

Affiliation:

* Graduate School of Engineering, Nagoya University * * Green Mobility Collaborative Research Center, Nagoya University, *** Ecotopia Science Research Institute, Nagoya University

Author(s):

○Jun Kang*, Oi.Lun.Li** Nagahiro Saito*, **, ***

Abstract:

Lithium-air battery, due to its high energy density, has a big potential for future electrochemical power sources. It has a theoretical energy density equals to gasoline, and an energy storage is 5 to 15 times greater than that of Lithium-ion battery (1, 2). However Li/air cell has low rechargeability and its energy performance falls short of the theoretical estimated value, primarily because the discharge terminates well before all pore volume of the air electrode is filled with lithium oxides. Therefore, the concept of using oxygen in a Li-air battery requires an air electrode consists of both proper catalysts for oxygen reduction(evolution) reaction (ORR, OER) and a highly porous structure. These two requirements should be considered simultaneously for designing an air electrode. Here we demonstrate a simple and versatile synthesis of Nano particles (NPs) catalysts with Carbon Nano Ball (CNB) from benzene under solution plasma process.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-1

Title:

Basic study on Flow Control by Using DC Corona Discharge

Affiliation:

Graduate School of Engineering, Sizuoka University

Author(s):

○Yoshinori Mizuno、Marius Blajan, Kazuo Shimizu

Abstract:

A DC corona discharge for active flow control under atmospheric pressure has been developed. A DC corona discharge electrode setup was designed to modify the airflow on a flat plate. The electrode configuration consisted of sharply pin electrode and grounded plate electrode. Weak light emission was observed at the edge of pin electrode with energizing electrode system. The discharge induced airflow called ionic wind whose velocity was measured with a hot wire velocity meter (up to 2 m/s). It was observed an increasing flow velocity by increasing corona discharge voltage. Saturation of the flow velocity occurred by increasing discharge voltage.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-2

Title:

Degree of cure measurement of painted surface by a non-contact surface resistivity measurement

Affiliation:

*Graduate School of Science and Engineering, Yamagata University.

**KASUGA ELECTRIC WORKS LTD.

Author(s):

○Kohei YAMAGUCHI*, Toshiyuki SUGIMOTO*, Nobuo NOMURA**

Abstract:

For evaluating thickness and hardness of the painted surface on the plastic material, there are only destructive techniques scratching or cutting the cured painted surface. It is necessary to wait paint curing to make the measurement for feeding back the measured data to the painting process. The measurement of the surface potential of the coating film along with the corona charging has been investigated for monitoring of the real-time curing state. It was found that there was a relationship between the pencil hardness and the surface potential.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-3

Title:

Low-Temperature Sintering Technique for Dye-Sensitized Solar Cells Using Reactive Oxygen

Affiliation:

*Department of Advanced Energy, The University of Tokyo、 **Department of Electrical Engineering, The University of Tokyo

Author(s):

○Shungo Zen*, Ryo Ono*, and Tetsuji Oda**

Abstract:

Dye-sensitized solar cell (DSSC) requires sintering of TiO₂ photoelectrode at 450. ~ 550 .C to be manufactured. However, the high-temperature sintering is disadvantageous because it limits the use of materials that cannot withstand high temperatures. In our previous work, we proposed plasma and low-pressure mercury (Hg) lamp ultraviolet (UV) treatments of the TiO₂ electrode to reduce the sintering temperature. It was concluded that the effect of the surface treatment is due to reactive oxygen species (O₃, O, OH) produced by the plasma and UV light. In this paper, we investigate the effect of each reactive oxygen specie by changing background gas of the treatment of the TiO₂ photoelectrode. It is shown that both O and OH radicals can cause necking of TiO₂ nanoparticles, while O₃ causes vaporization of solvent and organic binder in the TiO₂ paste. In addition, we propose a new treatment technique for the TiO₂ photoelectrode using a Xe₂ excimer lamp, which efficiently produces O and OH radicals compared with the low-pressure Hg lamp. For 250-.C sintering, the UV treatment time is reduced by an order of magnitude by using the Xe₂ excimer lamp instead of the low-pressure Hg lamp.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-4

Title:

Aging Characteristics of performance of the slightly reduced TiO₂ photocatalyst

Affiliation:

*College of Industrial Technology, Nihon University, **Tokyo University of Science

Author(s):

○Shota YAZAWA*, Tomohiko TAKEUCHI**, Shota ARAKI**, Yusuke KUDO*, Tetsuya NAKANISHI*, Noboru KATAYAMA** and Sumio KOGOSHI**

Abstract:

A photocatalyst is attracting widespread attention because it works semipermanently under light irradiation. A photocatalyst has useful characteristics such as an oxidative decomposition and a super-hydrophilicity. However, TiO₂ photocatalysts which are often used can be activated only by ultraviolet rays. A slightly reduced TiO₂ is one of visible light responsible photocatalysts. A slightly reduced TiO₂ can be produced with H₂-plasma surface processing. In this study, we have focused on aging characteristics of the slightly reduced TiO₂ photocatalyst. The performance of produced slightly reduced TiO₂ photocatalysts kept changing for one month. After that, the performance was stable for six months.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-5

Title:

Modeling of gasdynamic effects in an atmospheric pressure streamer discharge

Affiliation:

The University of Tokyo

Author(s):

○Atsushi Komuro, Ryo Ono

Abstract:

The mechanisms of gas dynamics occurred in an atmospheric-pressure streamer discharge are studied with our previously developed two-dimensional streamer discharge simulation model. In this paper, the effects of gas dynamics which is induced by the fast gas heating in an atmospheric pressure streamer discharge are modeled. The simulation shows that the streamers generate a thermal shock near the anode point, and the gas expand with a propagation velocity of the speed of sound in air. After the thermal shock, the gas gradually diffuses and therefore the temperature decreases.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-6

Title:

Generation of Atmospheric-pressure Mist Plasma Jet and its Characteristics

Affiliation:

Graduate School of Science and Technology, Kumamoto University,
Japan *

Priority Organization for Innovation and Excellence, Kumamoto University,
Japan * *

Institute of Pulsed Power Science, Kumamoto University,
Japan * * *

Author(s):

○ Norimitsu Takamura * , Douyan Wang * * , Takao namihira***, Hidenori
Akiyama*

Namihira * * * , Hidenori Akiyama *

Abstract:

Atmospheric-pressure plasma jets have much attracted attention in the field of medical applications, especially for such uses as surface treatment, sterilization, and tooth whitening. These applications are based on various phenomena produced by the plasma jets, such as UV light emission, electrons, ions, and radicals. Especially, in the case of sterilization, it has been known that OH radical produced by the plasma jets is one of most important factor to cause cells death. In this study, we focused on increasing the amount of OH radical production, and tried to generate Mist plasma jet as alternative to traditional method using only dry helium gas, called as Dry plasma jet.

In this study, it was found that 18 kHz, 18 kV, and 5 L/min of helium gas flow rate were best conditions to generate each plasma jet.

Furthermore, we measured the amount of OH radical produced by each plasma jet and compared its production ratio with each plasma jets. As a result, in the case of Mist plasma jet, the highest production ratio of OH radical was shown. This result suggests that Mist plasma jet has a possibility to increase the efficiency of sterilization or various medical applications using the plasma jets.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-7

Title:

Nanosecond time-resolved observation of underwater primary streamer

Affiliation:

Graduate School of Engineering, Tohoku Univ.* , Department of Electrical & Electronic Engineering, Oita Univ.* *、 Institute of Fluid Science, Tohoku Univ.* * *

Author(s):

○Hidemasa Fujita*、 Seiji Kanazawa* *、 Kiyonobu Ohtani* * *、 Atuski Komiya* * *、 Toshiro Kaneko*、 Takehiko Sato* * *

Abstract:

A series of the propagation processes of a primary streamer was visualized with an exposure time of 5 ns at 100 Mega frame per second (100 Mfps) by the use of an ultra high-speed camera with a microscope lens when a single-shot pulsed positive voltage was applied to a needle-to-wire electrode system, set in quartz glass cell filled with ultrapure water. From the synchronization of the pictures with the current waveform, it was found that a primary streamer propagated during the flow of pulsed repetitive currents. The propagation velocity was almost constant while pulsed currents were detected on the current waveform.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-8

Title:

Study of Low Frequency Electric Field Induced by Charge Oscillation

Affiliation:

National Institute of Advanced Industrial Science and Technology

Author(s):

○ Kazuya KIKUNAGA, Hiroshi YAMASHITA, Masahiro EGASHIRA and Kazuhiro NONAKA

Abstract:

Electric field induced by charge oscillation has been characterized by means of simulation of electric field distribution by Method of Moment in the Frequency Domain. Also, an electric field was induced by the spatial oscillation of a sample applied direct voltage. The simulation and evaluation of the electric field are clarified that the efficiency for inducing electric field bear a proportionate relationship to amplitude displacement of a charged object, and it is possible to detect the electric field from the top to the side of the object.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-9

Title:

Relative Humidity Measurement by Laser Induced Fluorescence

Affiliation:

The University of Tokyo, *Iwate University

Author(s):

Ippei YAGI, Ryo ONO, Tetsuji ODA, *Koichi TAKAKI

Abstract:

Spatially-resolved humidity distributions on wet surfaces with dry-gas flow are measured by laser induced fluorescence method. The quenching rate of H₂O for NO(A) state is utilized for detections of relative humidity. The spatial resolution is 1×0.2 mm² settled by laser thickness. Dry gases spread along the wet surfaces with increasing flow rate. The relative humidity becomes higher toward outside of the flow. Diffusion layers are compressed by higher flow rate. A humidity at an agar surface instead of human skin is 60-70% lower than a water surface.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-10

Title:

Inactivation of *Staphylococcus aureus* on Electrode by Ozone

Affiliation:

Kanagawa Institute of Technology

Author(s):

○Ryoya MANO, Hirotaka MIYASHITA, Yoshihiro KAWADA, Akinori ZUKERAN, Jun SAWAI

Abstract:

The inactivation of *Staphylococcus aureus* by ozone was investigated using corona discharge, which was generated in atmospheric air. The experimental system consisted of high voltage spike-plate electrode and grounded plate electrodes, which spacing is 10 mm. *Staphylococcus aureus* were deposited on the grounded plate electrode, and then exposed in the corona discharge or the electrostatic field. The applied voltage was between DC -6.2kV and -10kV, ozone concentration was between 0.06 ppm and 5 ppm, the exposure time was between 1 h and 8 h, the gas velocity was 0.5 m/s. The influence of corona discharge and the ozone concentration on the inactivation was investigated. The influence of the exposure time was also investigated. As a result, it was indicated that the effect of corona discharge on the inactivation was greater than that of electrostatic field in the air included ozone. However, the survival in electrostatic field decreases with increasing the exposure time due to the effect of ozone.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-11

Title:

Inactivation of *Caenorhabditis elegans* with pulsed electric field treatment

Affiliation:

Graduated School of Engineering, Gunma University

Author(s):

○Takanori TANINO, Takuya OKADA and Takayuki OHSHIMA

Abstract:

Inactivation of *Caenorhabditis elegans* in pulsed electric field (PEF) was studied. Experimental results and electric field strength simulation in the treatment chamber indicated that *C. elegans* could be inactivated in the electric field strength of 1 kV/cm. Because general bacterial cells can be inactivated in the field strength of 10 kV/cm, nematode seems to be very sensitive toward PEF. We also compared the inactivating efficiency of the egg, larva, and adult *C. elegans* with PEF treatment. The egg was most sensitive to PEF treatment, more than 90 % of the *C. elegans* egg was inactivated after 4.0 kV and 2 sec of PEF treatment. Although the larva, and adult *C. elegans* was resistant to PEF treatment, the survival ratio 1 day after PEF decreased than that just after PEF treatment. Fluorescence microscopic analysis of fluorescently-stained *C. elegans* after PEF treatment showed that the head, tail, epidermis and muscle of *C. elegans* tend to be damaged by PEF treatment. And it was suggested that inactivation measurement method based on ATP content could be partially applied to inactivation measurement of *C. elegans*.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-12

Title:

Influence on Plant Growth by Irradiation of Atmospheric-pressure LF Plasma Jet onto the Seed

Affiliation:

Department of Electrical and Electronic Engineering, OitaUniversity

Author(s):

○Kei ETO, Yuki ANAN, Shuichi AKAMINE, Ryuta ICHIKI, Seiji KANAZAWA

Abstract:

In this study, seeds of radish sprouts were irradiated by atmospheric-pressure low frequency (LF) plasma jet. Here, helium gas was used as an operating gas. We evaluated influence of the atmospheric-pressure plasma jet on growth of the plants by measuring the stem of radish sprouts and comparing with a control group. We also measured concentration of glucose in the seeds. As a result, growth of the plants which was immersed into water before the plasma jet irradiation was enhanced compared with the control group. Moreover, we found that the concentration of glucose in the seeds was increased.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-13

Title:

Plasmonic imaging of Brownian motion of single DNA molecules spontaneously binding to silver nanoparticles

Affiliation:

*Health Research Institute, National Institute of Industrial Science and Technology (AIST), **Department of Physics, Kyoto University, ***Faculty of Life and Medical Sciences, Doshisha University, ****Department of Applied Chemistry, Graduate School of En

Author(s):

○ Tomomi ISHIDO*, Yuko YAMAMOTO*, Masatoshi ICHIKAWA**, Kenichi YOSHIKAWA***, Yoshinobu BABA****, Tamitake ITOH*, Ken HIRANO*

Abstract:

We report on video-rate imaging of single DNA molecules labeled with silver nanoparticles (AgNPs) in aqueous solution. Mn^{2+} (3 mM) is added to promote DNA binding to AgNPs. The effectiveness of this approach was verified by fluorescent microscopy, SEM, and UV-vis spectroscopy. Dark-field optical microscopy enables the Brownian motion of single DNA molecules to be analyzed through AgNP plasmon resonance scattering. Video-rate imaging of single DNA molecules at 30 fps is possible. In addition, dark-field optical microscopy uses inexpensive equipment, in contrast to fluorescence microscopy. The proposed method also overcomes the drawbacks to using fluorophores and QDs for DNA labeling, thereby enabling longer observation times and pH-independent observations. Thus, this study is expected to contribute to the study of topics including single-molecule DNA dynamics and DNA/protein interactions.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-14

Title:

Apoptosis Induction of Murine Skin Cancer Cell by Atmospheric Pressure Plasma Using Nanosecond Pulsed Power Generator

Affiliation:

*The University of Tokyo, **Toyohashi University of technology, ***Iwate University

Author(s):

○Kenta HIRAKATA*, Ippei YAGI*, Ryo ONO*, Tetsuji ODA*, Kazue MIZUNO*, Hirohumi KURITA**, Akira MIZUNO**, Koichi TAKAKI***

Abstract:

Recently it is expected that atmospheric pressure plasma is useful to induce apoptosis, and plasma is used to cancer treatment. We used murine skin cancer cell (B16F10) and irradiated plasma to this cell. So according to plasma irradiating time and gas, cells either increase or decrease. And we detected apoptosis with AnnexinV/PI staining. Moreover we compared cancer cell and fibroblast cell (NIH3T3), and we verified the difference of effect between cancer cell and fibroblast cell.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-15

Title:

A new fabrication method of in vivo protein array with high voltage pulse application

Affiliation:

Graduate School of Engineering, Gunma University

Author(s):

○ Hidefumi Miyata, Yuto Ishiguro, Nobuyuki Oshima, Ayumu Utsumi, Syunsuke Takahashi, Masahiko Oshige and Shinji Katsura

Abstract:

This paper reports a new method of "in situ" immobilization of recombinant proteins on a modified gold substrate. His-GFP (His-tagged Green Fluorescent Protein) was used as the recombinant protein in this article. Escherichia coli bacteria bearing His-GFP molecules soaked in lysozyme solution to hydrolyze the peptidoglycan layer of E. coli bacteria. Then, the treated E. coli bacteria were spotted on the gold substrate and high voltage pulses were applied to the substrate. The remaining inner cell membrane of E. coli were broken down by the application of HVP (High voltage pulse), resulted in release of the cytosol protein and His-GFP molecules. The released His-GFP molecules were immobilized on the surface of the gold substrate through specific interaction between His-tag and tag-recognition group. Amount of immobilized His-GFP molecules were estimated with the fluorescence intensity. When the charging voltage was 10 kV, the fluorescence intensities reached plateau at three pulses in number of the applied pulses. The threshold amount of the charging voltage was 3 kV when HVP were applied three pulses. Those immobilized His-GFP were released by washing with imidazole, suggesting that the immobilization involved specific binding between the His-tag and the tag-recognition group.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11aC-16

Title:

A novel gene transfection technique using water-in-oil droplet in an electrostatic field

Affiliation:

Department of Environmental and Life Sciences, Toyohashi University of Technology *

Author(s):

○Shota Takahashi, Hirofumi Kurita, Atsushi Asada, Rika Numano, Kazunori Takashima and Akira Mizuno

Abstract:

In this study, we have demonstrated a method for gene transfection quite different from conventional one. This method is based on water-in-oil droplet manipulation by using electrostatic force. When a water droplet is placed in oil, it is driven between a pair of electrodes by applying a DC electric field. This droplet motion is brought about as follows :

a droplet is carried to one electrode by coulomb force possibly due to inherent charge. When the droplet touches to the electrode it is charged with the same polarity as the electrode. The droplet then moves to the other electrode and the same process occurs repeatedly. In this process, local and intense electric field is applied to the droplet in a very short time when it touches the electrode. This local intense electric field must work on a gene transfection. We have investigated a gene transfection by using the droplet containing cultured mammalian culture cells (HEK293 cell) and foreign plasmid DNA (CMV-Venus plasmid)

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pC-1

Title:

Investigation of Metabolic Characteristics for Heat-Treated Yeast by Dielectrophoretic Velocimetry

Affiliation:

Tokyo Metropolitan Univ.

Author(s):

○Shin TAKAZAWA, Naoki SHIRAI, Satoshi UCHIDA, Fumiyoshi TOCHIKUBO

Abstract:

Constant monitoring and detailed inspection of microbial metabolism have been required for advanced quality control in food industry and medical practice. In the present work, the change in metabolic states for injured *Saccharomyces cerevisiae* (*S. cerevisiae*) with heat treatment was investigated using dielectrophoretic (DEP) velocimetry in a micro-cell. Fluorescent observation of stained *S. cerevisiae* showed gradual destruction of the membrane structure by heat treatment. Numerical analyses of Clausius-Mossotti function for various electrical parameters clarified that DEP velocity depends strongly on inner-wall conductivity from 0.1 to 1 MHz and cytoplasmic conductivity from 1 to 10 MHz. These results suggest that DEP velocimetry would be available for rapid and simple estimation of the metabolic states.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pC-2

Title:

Development of Direct Gene Delivery System into Adherent Cell Nucleus Using On-Chip Electroporation

Affiliation:

*Dept. Bioengineering, The University of Tokyo, **Dept. Mechanical Engineering, The University of Tokyo, ***Center for iPS Cell Research and Application, Kyoto University, ****Dept. Mechanical Engineering, Kyoto University

Author(s):

Osamu KUROSAWA*, Kennedy OMONDI OKEYO**, Hidehiro OANA**, Keisuke OKITA***, Hidetoshi KOTERA****, Masao WASHIZU*,**

Abstract:

We developed a novel gene delivery system based on on-chip electroporation for introduction of plasmids directly into the nucleus of adherent cell by electrophoresis. The orifice sheet with adherent cells was inserted between AgCl electrodes and a pulse of 4V-200msec was applied in a DMEM medium containing GFP plasmids. Most cells showed GFP expression within 2 hours after pulsation, suggesting that the plasmid was directly introduced into the cell nucleus. Making the orifice pitch nearly equal to nucleus diameter increased the effect of field constriction at a micro orifice, resulting in higher yield of GFP expression. We applied this direct gene delivery system to produce iPS cells. After introduction of Yamanaka factors, cells were cultured on the orifice sheet for three weeks after electroporation, and then reprogramming of nucleus was checked using Oct4 and Nanog antibodies. Cells which had formed colony stained positive for both antibodies of Oct3/4 and Nanog, showing successful reprogramming of cell nucleus.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pC-3

Title:

Investigation of Dielectrophoresis of Adenovirus and Rotavirus

Affiliation:

Faculty of Information Science and Electrical Engineering, Kyushu University

Author(s):

Michihiko Nakano, Ryoji Obara, Zhenhao Ding, Junya Suehiro

Abstract:

In this study, it was measured that dielectrophoretic properties of adenovirus and rotavirus. There is a great concern about virus thread. Goal of this study is to detect virus by dielectrophoretic impedance measurement (DEPIM) method, which based on dielectrophoretic trapping of target materials on a microelectrode and measurement of impedance change due to the trapping. DEPIM is a simple and sensitive method and has been in practical use for detecting oral bacteria. To apply DEPIM for virus detection, dielectrophoretic property of virus should be known. Dielectrophoresis of fluorescent-labeled adenovirus and rotavirus were optically observed under various conductivity of suspending mediums. Then, crossover frequencies of the viruses were determined.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pC-4

Title:

Electrofusion Employing Electric Field Constriction for High Yield Generation of Hybridomas for Monoclonal Antibody Production

Affiliation:

Department of Mechanical Engineering, University of Tokyo, **Department of Bioengineering, University of Tokyo, ***Department of Microengineering, Kyoto University

Author(s):

Kennedy O. OKEYO*, Yasuhiro NISHIGAICHI**, Takehiro KONDO*, Osamu KUROSAWA**, Hidehiro OANA*, Hidetoshi KOTERA***, and Masao WASHIZU**

Abstract:

A high-yield electrofusion method has been developed for the fusion of B-cells with myeloma cells to form hybridomas for monoclonal antibody production. The method utilizes dielectrophoretic force (DEP force) due to electric-field constriction at a micro-orifice to manipulate and position B-cells and myeloma cells one-to-one on opposite sides of multiple micro-orifices embodied on a thin insulating membrane. By using a low conductivity medium, cells on either side of each micro-orifice could be brought into contact by applying a 5V DEP voltage at 1MHz, and a fusion efficiency of 80% was realized by applying a 3-5V pulse voltage for 100 μ s. Fused cells were harvested and cultured in HAT medium, resulting in the formation of multiple colonies after 3 days of culture, suggestive of successful hybridoma formation. Moreover, the yield rate, as determined by the ratio of the number of B cells to the number of colonies formed, was 2×10^{-3} , which is 20-2000-fold higher than that obtained by the typical PEG fusion method. Thus, the micro-orifice-based electrofusion method can be used to generate hybridomas for monoclonal antibody production with B cells harvested from the lymph at a much lower cost compared to the typically used spleen.

第 37 回静電気学会全国大会アブストラクト集

Program number:

11pC-5

Title:

Medical Application of Pulse Power in Edo and Meiji Periods

Affiliation:

Graduate school of Tottori University

Author(s):

Ryo NISHIMURA

Abstract:

Friction generators came to Japan in the 18th century. It was firstly introduced by Rishun Goto (1702-1771), a scientist, in his book as a medical apparatus that could remove pain. Since then, an electric power, especially pulse power, was believed to cure various kinds of illnesses. Many apparatuses that generated pulse power were produced as medical apparatuses during late Edo and Meiji periods. Teijun Yamada (? ~ 1905) and Housaku Sugisei (? ~ ?) edited books titled “Naifukudoukou” about medical external treatments in mid-19th century (end of Edo period). Mechanism and efficacy of two kinds of pulse power generators are described in the books. One is a friction generator and the other is a booster circuit that boosts a voltage of Volta’s battery by using a switching device and a transformer.

This paper describes the medical application of pulse power in end of Edo and Meiji periods based on “Naifukudoukou” and an instruction book on medical apparatuses published in Meiji period.