第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-1

Title:

Mechanical and Dielectric Breakdown Properties of Heat-Treated Polylactic Acid with Flexible Resin

Affiliation:

Hachinohe Institute of Technology

Author(s):

Naru MATSUGASAKI、○Katsuyoshi SHINYAMA、Shigetaka FUJITA

Abstract:

Poly-lactic acid (PLA), a type of bioplastic, is known to have high insulation resistance at room temperature. As PLA is a hard-type resin, it has to be softened in order to be used as an electric wire sheath material. We examined the mechanical and breakdown properties of heat-treated poly-lactic acid (PLA) with flexible resin. The result, the tensile strength at break of heat-treated PLA has improved when flexible resin is added compared with LDPE. On the other hand, the breaking elongation was feel. The temperature dependence of the breakdown strength (EB) of heat treated PLA with flexible resin was investigated. The PLA achieved breakdown strength comparable to that of LDPE.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-2

Title:

DC Corona Discharge from a Fine Water Droplet Formed at a Tip of Capillary Electrode

Affiliation:

Graduated School of Science and Engineering, Yamagata University

Author(s):

○Satoshi Sugimoto, Yoshio Higashiyama

Abstract:

Corona discharge from a water drop is different that from a metal electrode. In addition. corona discharge current waveform shows complicated aspect due to formation of a Taylor cone of a water droplet and ejection of a fine jet. To clarify the influence of vibration of the cone of water droplet on negative corona discharge from a water droplet, nano-litter droplet was formed at a tip of capillary tube with 0.2mm diameter. The waveform of corona current from a water droplet manifests periodic pulse groups. These pulse groups would correspond to the vibrating motion of the water droplet. The occurrence frequency strongly depends of the applied voltage .

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-3

Title:

Loss current analysis of water tree using three dimensional equivalent circuit model

Affiliation:

Akita University

Author(s):

○Masafumi Suzuki, Noboru Yoshimura

Abstract:

It is widely recognized that degradation by water tree of electrical power cables would cause serious problems. Therefore, many methods have been studied in order to detect water tree at the early stages. The loss current analysis is one of the methods which can detect water tree, since the degradation of CV cable by water tree gives rise to harmonics in the loss current. Many researches by simulation and experiment have been carried out for the purpose of the elucidation of the mechanism of the harmonics in the loss current generation. In the present study, a polyethylene sample where water tree was generated was replaced by the equivalent circuit composed of a lot of resistance, capacitor and voltage dependent resistance. These elements were united like the network. It will be possible to consider not only length of water tree but also shape of water tree by this method. From the simulation results, it has been understood that the characteristics of loss current vary greatly depending on not only the length of water tree but also the shape of water tree.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-4

Title:

Measurement of active oxygen on Ag supported catalysts surface after atmospheric plasma treatment

Affiliation:

National Institute of Advanced Industrial Science and Technology (AIST)

Author(s):

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

Abstract:

In this paper, the fixation of gas phase oxygen on the catalyst surface by non-thermal plasma (NTP) is studied under atmospheric-pressure. In this experiment, a barrier type plasma reactor packed with catalyst, Ag 15 wt%/MS-13X (295 m2/g), is used. The size of the Ag nanoparticles on the MS-13X surface is in the range of 1–5 nm according to TEM analysis. After O2 plasma treatment of catalyst, the gas flow was switched to NO (100 ppm)/N2 and the concentrations of NO and NO2 are monitored by FTIR. The results indicate that catalyst after O2 plasma treatment can oxidize NO to NO2, and oxygen is fixed on the catalyst surface by plasma treatment. The lifetime of oxygen on the catalyst surface under dry air atmosphere is measured 1000 min after plasma treatment. The result indicates that about 70 % of oxygen on the catalyst surface exists compared with value measured just after plasma treatment.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-5

Title:

Long Term Endurance of Electrical Insulating Properties by LDPE Nano-Composite Added with Azobenzoic Compound

Affiliation:

Faculty of Education, Chiba University

Author(s):

Y.Yamano

Abstract:

Polymer nano-composite with azobenzoic compound was designed to ensure a high performance for electrical treeing resistance in the long term. The nano-composite was prepared by mixed addition of azobenzoic compound and Al2O3 nano-particle into LDPE. The suitable azobenzoic compound for the long term performance was 4'-hydroxyazobenzene-2-carboxylic acid (hy_Ab) which was selected from six kinds of the compound. The evaluation points for the suitable azobenzoic compound were a high melting point and non-bleeding out from LDPE. The conducting current in the composite with hy_Ab was limited to a value about ten times smaller than that in nano-composite without compound. This indicates that addition of hy_Ab promotes the dispersion of nano-particle in the bulk. Furthermore, development of PD on a sheet of LDPE composite with Al2O3 was restricted by the addition of azobenzoic compound into LDPE. The most effective restriction was achieved when hy_Ab was used as the compound.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aA-6

Title:

Initial process for division and electrification of water droplets on the superhydrophobic surface

Affiliation:

Kanagawa Institute of Technology

Author(s):

○Hirofumi SHIMOKAWA and Takeshi YONEYAMA

Abstract:

In the previous report, it was shown that the small droplet was ejected from the dripping water droplet which drops on the superhydrophobic surface , and the charge of ejected droplet and dripping droplet increased with the electrification of the surface. This report examined the charge of a drop to 10 drops on the neutral surface. The water-repellent is the fluoro-type or the silica type. It was found that the charge of the first dripping droplet was the highest value. This phenomena was relative to the electrification of the surface. It was also found that the electrification of the silica type was reversed with the fluoro-type.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-1

Title:

Study of surface discharge in water for water puri cation

Affiliation:

∗Department of Electrical Engineering,The University of Tokyo

Author(s):

◯Shintaro Ueno∗, Ryo Ono∗, and Tetsuji Oda∗

Abstract:

Advanced oxidation processes (AOPs) are considered to be promising alternatives for the treatment of pollutants. One of the AOPs methods is pulsed high-voltage discharge.The purpose of this study is improvement the energy efficiency by the synergy effect with pulsed high-voltage discharge and the catalyst in the water treatment.This study focus on spark discharge, micro-bubbled water, and catalyst with metal nano particles for generating surface discharge on the catalyst in water. The results showed catalyst with metal nano particles have the potential of generating surface discharge.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-2

Title:

Decolorization of mixed solution of organic dyes 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 organic two dyes has been investigated. Indigo carmine and azo pholoxine were employed as specimens to evaluate decomposition efficiency. Oxygen or argon gases were injected into the water near the high-voltage wire electrode to generate plasma to identify the dominant reactions of the decolorization of the dye solutions.The energy efficiencies for decolorizationof two dyes in single dye solutionswerealmost samein the case of argon injection.Indigo carmine was decolorizedwith higher energy efficiency than that of azo pholoxine in the case of oxygen injectionin single dye solution. Indigo carmine and azo pholoxine in the two dyes mixing solution were completely decolorized. Indigo carmine was preferentiallydecomposed in the case of the mixed solution.These results show reaction rates of indigo carmine and chemical species such as ozone and hydroxyl radical are much higher than that of azo phloxine.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-3

Title:

Measurement of OH Radicals Produced by Discharge in Water Using a Chemical Probe Method

Affiliation:

Department of Electrical and Electronic Engineering, Oita University

Author(s):

○Takeshi NAKAJI, Seiji KANAZAWA, Takashi FURUKI, Shuichi AKAMINE, Ryuta ICHIKI

Abstract:

Pulsed streamer dischargesgenerated in water areof great interest for a number of applications. The formation of hydroxyl (OH) radicals in the region of streamer propagation has so far been demonstratedby optical emission spectroscopy. In this study, OH radicals in water weremeasuredusing achemical probe method. OH radicals were observed indirectlyby detecting fluorescence from fluorescent hydroxyterephthalic acid(HTA)and fluorescein. These components are produced through OH reaction with terephthalic acid (TA)and hydroxyphenyl fluorescein(HPF), respectively. Wefound that boththe fluorescentintensitiesincreased withdischarging time.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-4

Title:

Difference in the Decomposition Processes of Perfluoro Compounds　Using Plasma on Gas‐Liquid Interface and Sulfate Radical Anions

Affiliation:

Tokyo Institute of Technology

Author(s):

Yuzuru KITAGAWA, Akihiro KOSUGI, ○Nozomi TAKEUCHI, Koichi YASUOKA

Abstract:

Perfluorooctanoic acid (PFOA: C7F15COOH) in water was decomposed　using plasma generated inside oxygen bubbles and sulfate radical anions.　During the decomposition of PFOA, perfluoro carboxylic acids (PFCAs:　CnF2n+1COOH) with shorter carbon chain (n = 1-6) were generated in the　water. By measuring the concentrations of the PFCAs, the decomposition　processes were compared. With plasma, the decomposition reactions that　the number of carbons in the carbon chain of the PFCAs decreased by two　or more seemed to be dominant. On the other hand, most reactions with　sulfate radical anions decreased the number of carbons one by one.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-5

Title:

Decomposition of Organic Compound in Water by Using Atmospheric Microplasma

Affiliation:

Organization for Innovation and Social Collaboration，Shizuoka University

Author(s):

Naoto Masamura

Abstract:

Plasma could be used as the water treatment technology to decompose the organic compound or to sterilize various bacteria. However plasma is generally difficult to generate in water due to the high electric conductivity of water. Microplasma which is non-thermal dielectric barrier discharge generated between a pair of electrodes covered with dielectric layer and faced together with a pacer of 100 ＝m. Thus Our Microplasma can be used only low discharge voltage due to the narrow discharge gap. Thus, it can be applied various field such as biomedical, environmental and for surface treatment of polymers or glasses. Active species, radicals and ions such as OH and ozone are generated during microplasma discharge. Indigo carmine was used as the treatment target in this research. This target is often used for the food additive in our life. The various active species and radicals generated by microplasma were effected to decompose the organic compounds in the solution. Microplasma electrodes were placed small distance above the water thus active species and radicals are flown by the gas towards the water surface to react with the target to be decomposed.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-6

Title:

Decomposition of 1,4-Dioxane by Discharge inside Bubble in Water with Fenton reaction.

Affiliation:

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

Author(s):

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

Abstract:

Water purification by discharge inside bubble in water containing 1,4-dioxane has been investigated. A tungsten wire was inserted into glass tube, which was immersed in the water. Argon gas was injected into the glass tube to generate bubbles in the water. The pulsed high voltage generated by a magnetic pulse compression circuit was applied to the tungsten wire to generate streamer discharge. A 316 stainless or iron wire was immersed in the water and used as ground electrode. The total organic carbon (TOC) of 1,4-dioxane solution decreased by discharge. TOC removal rate in the case of iron wire was higher than that of 316 stainless wire. Iron ions were eluted by the discharge current. Iron ions react with hydrogen peroxide produced by the discharges and produce hydroxyl radical through a redox reaction (Fenton reaction), which enhanced the TOC removal rate.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aB-7

Title:

Development of the NH3 generation technology using superheated steam and the electric discharge plasma

Affiliation:

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

Author(s):

Kenji Yamasaki、Hirofumi Kurita、Kazunori Takashima and Akira Mizuno

Abstract:

In this paper, I combined superheated water vapor and atmospheric pressure electric discharge plasma to reduce NOX and N2 effectively. The superheated water vapor and nitrogen were treated under the discharge plasma generated by packed bed reactor. I examined the optimum condition for the NH3 generation. Also, CO addition was examined to improve generation efficiency of the NH3. As a result, I was not able to generate NH3 gas. However, I found the NH4+ dissolved in water when the applied voltage was 10,13,16 kVeff. This result, suggests that generation of the NH3 was succeeded. The NH4+ production was highest 7 mg/L with the applied voltage of 10kV. When CO was added NH4+, The production was approximately 2 times higher than that without CO. The use of CO was effective to improve the NH3 generation efficiency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-1

Title:

Behaviors of EHD-pillar of liquid

Affiliation:

Kanagawa Institute of Technology

Author(s):

Tsuyoshi SEKIDO

Abstract:

The liquid in which the electric field was applied is transformed and flows. This is known as EHD phenomena. This study is examined the EHD rise of the liquid. EHD-pillar of liquid with the about 1cm length arose, when the negative voltage was applied to the needle electrode. And it arose only in the ethanol. In addition, the rotation’s direction of the EHD-pillar was mainly the left.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-2

Title:

Ultra small temporal and spatial measurement of a streamer in water

Affiliation:

Institute of Fluid Science, Tohoku University

Author(s):

Takehiko Sato

Abstract:

A series of photographs for a streamer propagation process in water was successfully observed using a pulse discharge system, an ultra high speed camera system with a microscope lens and a Mach-Zehnder interferometer. After the initiation process of 600 ns - 800 ns from the applying voltage of 16 kV0p, the primary streamer occurred accompanying the spherical shaped shock wave, then the secondary streamer started to propagate beyond the spherical shock wave. The discharge current increased correspondingly when the primary streamer occurred and the secondary streamer expanded.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-3

Title:

Effectiveness of Electrostatic Pesticide Spraying for Japanese Pears

Affiliation:

＊Graduate school of Tottori University, ＊＊Arimitsu Industry Co., Ltd.

Author(s):

○Ryo NISHIMURA＊, Satoko FUJITA＊, Shota MICHIHARA＊, Takashi MASUOKA＊＊,Toshihiro KIMURA＊＊, Shinji YATSUZUKA＊＊ and Shinobu ANAGUCHI＊＊

Abstract:

Electrostatic pesticide spraying (EPS) improves the adhesion characteristics of the pesticide solution to agricultural crops. If the adhesion characteristics are improved, the requisite amount of the pesticide to be sprayed can be reduced in comparison with the conventional spraying method that uses non-charged pesticide. In this research, disease (rust) control experiments were carried out to substantiate the effectiveness of the EPS from a statistical point of view. We sprayed pesticide, which protects pear trees from rust, to potted Japanese pear trees under calm condition. A battery-driven sprayer, which is usually sold at Do-It-Yourself stores, was used in this research. The experimental results show that the pesticides used for the disease control for Japanese pear can be reduced by 25~60% by introducing EPS. It is estimated from the results that 27500~66000 m3/year of pesticides can be reduced for the Japanese pear cultivation in Tottori prefecture. Also, this means that the expense of the pear cultivation can be reduced by 120~290 million yen every year in Tottori prefecture by introducing EPS.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-4

Title:

Deliberation of Plasma Sensitivity Assessment by XTT Method in Saccharomyces cereviciae

Affiliation:

Department of Environmental Life Science, Toyohashi University of Technology

Author(s):

○Roger Martin AGUSTIN, Fumie NAKASATO, Hachiro YASUDA, Hirofumi KURITA, Kazunori TAKASHIMA, Akira MIZUNO

Abstract:

In this study, we examined a novel but simple and easy survival rate measurement method of Saccharomyces cereviciae after exposing to plasma jet using of XTT, which is a kind of the tetrazorium salt. There are few instances applying XTT to S.cereviciae so far. Therefore, firstly the measurement condition of XTT method for S.cereviciae was optimized. We examined the concentration of S.cereviciae cells, the amount of XTT and coloring reaction time to be able to obtaine enough amount of formazan suited measuring optical dencity(OD). Another tetrazorium salt WST-8 was also examined. As a result, applicable measurement condition of S.cereviciae survival rate was determined using XTT method. Survival ratios of S.cerivisiae mutant strains were measured after exposure plasma jet by standard agar plate culture method and the XTT method. Though minute differences were observed, survival ratios from the XTT method and standard agar plate culture method were found to be correlated in all strains of S.cereviciae examined.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-5

Title:

Inactivation of Caenorhabditis elegans with PEF treatment

Affiliation:

Dept. of Environmental and Chemical Eng., Gunma University

Author(s):

Takayuki OHSHIMA, Takuya OKADA and Takanori TANINO

Abstract:

Inactivation of Caenorhabditis elegans in pulsed electric field (PEF) was studied. Experimental results and electric field strength simulations 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 kV and 2 sec of PEF treatment. Although the Larva, and adult C. elegans was resistant just after PEF treatment, the survival ratio after 1 day decreased due to some sequel of PEF treatment.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-6

Title:

Apoptosis Induction on Fibroblast Cells by Atmospheric Pressure Plasma

Affiliation:

Department of Electrical Engineering and Information Systems, Graduate School of Engineering, The University of Tokyo

Author(s):

Takuma YASUDA

Abstract:

Apoptosis induction by plasma treatment is a promising technique for medical application such as tumor treatment, minimally invasive surgery and alternative to chemotherapy. A murine fibroblast cell (NIH3T3) treated by atmospheric pressure plasma increases and decreases with introduced gases and treatment duration. Apoptosis is detected using TUNEL assay and increases with plasma treatment duration. Cause of apoptosis is considered to be short-lived active species or ions in plasma.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13aC-7

Title:

Basic Study on Generation and Sterilization of Plasma Jet-like DBD Under Atmospheric Pressure

Affiliation:

＊Department of Mechanical and Electrical Engineering, Nippon Bunri University ＊＊Department of Media Technologies, Nippon Bunri University

Author(s):

○S. Hoketsu＊, H. Morisaki＊, K. Satou＊, H. Baba＊, S. Umeda＊, Y. Nakagawa＊, S. Wakamatsu＊, T. Kawasaki＊, and M. Sakai＊＊

Abstract:

Atmospheric non-thermal plasma has attracted attention of many researchers in the field of environmental and biomedical technologies. In this study, the sterilization effect was investigated using the sheet type plasma jet-like DBD, which was generated between asymmetric electrodes in helium flow and atmospheric air. Helium gas with a flow rate of 2.0L/min was supplied into the jet-like DBD generator applied a sinusoidal 1 kHz high voltage. Yeast with agar medium in a petri dish was placed onto the grounded electrode maximum 14 mm away from the tip of the generator. The influence of the applied voltage and electrode size on sterilization was investigated in order to obtain the conditions for wide area sterilization. The influence of oxygen on the sterilization was also investigated. It is indicated that there are optimum conditions for the electrode size from the view point the sterilization efficiency (mm2/W). The significant wide area sterilization was able to be obtained when oxygen with a concentration of 2.5% was mixed with helium.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-1

Title:

Generation mechanisms of OH radical in the effluent of an atmospheric-pressure helium plasma jet

Affiliation:

The University of Tokyo

Author(s):

Seiya Yonemori

Abstract:

Radial OH distribution in the vicinity of wet and dry surface was measured by laser induced fuorescence. Nearby the surface, OH density distribution varied depending on some parameters; helium gas ow rate, the gap between the surface and the end of capillary and [H2O] on the surface. The plasma jet was generated with high voltage of AC 5 kV, 8 kHz. When the plasma jet extended toward dry surface, the maximum OH density was approximately 0.4 ppm, located on r = 1:0 mm (r value means radial position from the center of the plasma jet). On the other hand, the maximum OH density was approximately 1 ppm on r = 1:5 mm when the plasma jet extended toward wet surface. The results suggest that OH radical is generated with the interaction of the plasma with H2O adheres on or evaporates from the surface.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-2

Title:

Temperature Dependence of Sliding Discharge

Affiliation:

SETEC Co. Ltd

Author(s):

○ Yoji NAKAJIMA and Hiroshi SETO

Abstract:

Sliding discharges are being actively investigated to control the boundary layer on aerofoil. Recently, surface plasma created by the sliding discharge is found more effective than the barrier discharge for the abatement of VOCs and NOx. We have tried to use the sliding discharge for exhaust gas treatment of diesel engines, and have found that the sliding discharge becomes unstable and occasionally turns to sparks at high gas temperature. A tentative experiment is made to reveal the effect of temperature on the sliding discharge.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-3

Title:

Numerical analysis for gas heating in an atmospheric pressure streamer discharge

Affiliation:

The University of Tokyo　Department of Advanced Energy Oda Ono lab

Author(s):

○Atsushi Komuro, Ryo Ono, Tetsuji Oda

Abstract:

Gas heating in an atmospheric pressure streamer discharge is analyzed with a two-dimensional streamer discharge simulation model.　This model includes the fast gas heating mechanism with an eye to an internal energy transfer of molecules.　In dry air condition, the gas heating occurs mainly due to dissociation reactions by electron impact of O2 molecules and processes of quenching of electronically excited N2(B, C) molecules by oxygen and excited O2(D) atoms by nitrogen. In humid air condition, the contribution of quenching from N2(a)　is added to these reaction. It is shown that the gas heating in discharge phase increases with humidity increases.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-4

Title:

Influence of Multiple Wire Electrode by Nano-seconds Pulsed Discharges

Affiliation:

*Graduate School of Science and Technology, Kumamoto University, Japan
**Priority organization for Innovation and Excellence, Kumamoto University, Japan
***Bioelectrics Research Center, Kumamoto University, Japan

Author(s):

○Satoshi SHIBUTA*, Douyan WANG**, Takao NAMIHIRA*** and Hidenori AKIYAMA*

Abstract:

At present, dielectric barrier discharge is the main method for ozone generation; however, as most of the energy is lost as heat, its low energy efficiency has been a problem. In recent years, our research group has demonstrated that the generation of ozone by thermal non-equilibrium plasma produced using nano-second(ns) pulsed discharge using short pulses of 5 ns has extremely higher energy efficiency. A present problem, though, is that maximum ozone concentration using the nano-second pulsed discharge becomes saturated at approximately 40 g/m3. In this work, we investigated ozone generation characteristics by employing a multiple wires electrodes. Additionally, we also investigated the influence on the direction of the multiple wire electrodes discharge. Our results indicate that ozone concentration rose with increase in input energy density. Furthermore, it will be observed that multiple wire electrode have positive effects on impedance matching. However, maximum ozone concentration of multiple wire electrodes was lower than single wire electrode.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-5

Title:

Comparison between Mechanism of Liquid Plasma Discharge Process in Water and Organic Solutions

Affiliation:

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

Author(s):

○Helena Oi Lun LI*, Jun KANG**, Kuniko URASHIMA ** and Nagahiro SAITO**

Abstract:

“Liquid in Plasma” has been demonstrated as a versatile process with high performance for many applications including nanoparticle synthesis, water purification, organic compound decomposition as well as sterilization. The application of electrical discharge in water has been studied for many years; however, liquid discharge under pure organic liquid has yet been thoroughly investigated. In this study, comparison of fundamental characteristics of plasma discharges under water and pure benzene were conducted. The solution plasma reactor was connected to a bipolar pulsed power supply with a pair of tungsten electrodes under 280 ml of solution. The discharge voltage and current were in the range of 1 - 2 kV and 4 - 16 kA, and the characteristics were found to be different between the two liquids. The discharge in water occurred in three different phases: pre-discharge, the initiation and the formation of discharge, whereas the discharge in benzene happened in two main steps: pre-discharging and the formation of discharge. By the observation of optical emission spectrum, significant H radicals were generated in discharge under water, accompanied with the formation of other active species such as O and OH. As for the discharge under benzene, the majority of active species changed to C2, and followed by CH and H.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pA-6

Title:

The effects of applied pulse voltage rise time on streamer discharge

Affiliation:

Department of Electrical Engineering and Information Systems, Graduate School of Engineering, The University of Tokyo

Author(s):

Yuya Yamanaka, Atsushi Komuro, Ryo Ono, and Tetsuji Oda

Abstract:

In this paper, the e ects of applied pulse voltage rise time on streamer discharge are discussed. The density of OH radicals is measured in pulsed positive corona discharge with various rise time using time-resolved laser-induced fluorescence(LIF). When the pulse voltage rise time is slow, the amount of OH radicals produced in the secondary streamer decreases. However, the same amount of OH radicals are produced in the primary streamer regardless of pulse rise time. The results indicates that the slow rise of applied voltage may improve the e ciency of OH radicals production.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-1

Title:

Effect of OH radicals on decomposition of volatile organic compounds by coaxial cylinder barrier discharge

Affiliation:

the University of Tokyo

Author(s):

Yusuke Nakagawa

Abstract:

Behavior of radicals in non-thermal plasma is worth clarifying in order to interpret the chemical reaction processes in the toxic gas decomposition by plasma. In order to reveal the oxidation processes in the decomposition, we made the coaxial cylinder DBD reactor emulating the practical gas treatment reactor and estimated the absolute density of OH radicals by laser diagnostics. The OH density is about 40 ppm at just after discharge. Besides, the rate constant of the reaction between OH and trichloroethylene (TCE) is also estimated to be 2.3£10−12 [cm3/s]. TCE decomposition efficiency by AC discharge in the same reactor is measured. It seldom depends on relative humidity (RH) when RH<20%, while it decreases as humidity increases when RH exceeds 20%. Similar pattern of decomposition efficiency dependence on humidity is duplicated by chemical reaction simulation considering the reasults obtained by OH density measurement.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-2

Title:

Ethylene Gas Decomposition Using Dielectric Barrier Discharge

Affiliation:

＊Faculty of Engineering, Iwate University、＊＊Faculty of Agriculture, Iwate University、＊＊＊Faculty of Agriculture, Kyusyu University

Author(s):

○Daichi MONOE＊, Koichi TAKAKI＊, Shoji KOIDE＊＊, Toshitaka UCHINO＊＊＊

Abstract:

Decomposition of ethylene (C2H4) gas using dielectric barrier discharge (DBD) was investigated experimentally for long-term preservation of fruit and vegetables. Gas mixture of 200 ppm C2H4 diluted with air was employed as simulated gas in the preservation box and was injected into the DBD plasma reactor. The experimental result indicated that the C2H4 concentration decreased to less than 1 ppm after remediation using the DBD reactor. The removal efficiency increased with decreasing gap length between electrodes and/or, increasing gas flow rate. The byproducts in the DBD reactor were analyzed by Fourier transform infrared spectrometer. The analysis result showed that The H2O and CO2 were mainly produced as byproducts with the C2H4 decomposition by the DBD reactor.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-3

Title:

Destruction of Naphthalene Using a Surface Dielectric Barrier Discharge Based-Reactor

Affiliation:

Department of Chemical and Material Engineering, Kanazawa University

Author(s):

○Ayman A. Abdelaziz, Takafumi Seto, and Yoshio Otani

Abstract:

The destruction of naphthalene, as an example of polycyclic aromatic hydrocarbons, by surface dielectric barrier discharge is investigated in air as well as dry and humidified nitrogen in order to understand the physical mechanism of its destruction. The destruction process is evaluated in term of the destruction efficiency, the energy efficiency and the byproducts formation. The characteristics of the microdischarges generated in the reactor were examined to understand the behavior of the destruction process. The results show The destruction efficiency was found higher in dry nitrogen than in air, and it decreased with the increase of the humidity, which indicated that that the nitrogen excited species play the big role in the destruction process rather than OH radical.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-4

Title:

Effect of Zeolite Composition on the Interaction with Discharge Plasma

Affiliation:

National Institute of Advanced Industrial Science and Technology (AIST)

Author(s):

oHyun-Ha Kim*, Yoshiyuki Teramoto*, Nobuaki Negishi* and Atsushi Ogata *

Abstract:

In this work, we focused on the effect of Si/Al ratio on the catalytic activity when it was combined with atmospheric-pressure oxygen plasma for the oxidation of volatile organic compounds (VOCs). Silver nanoparticles were impregnated on HY zeolites, which have different Si/Al ratios of 5.1, 30, and 80. The physical role of metal nanoparticles on the generation of discharge plasma on zeolites was visualized using the optical observation system, consisting of a microscope–ICCD camera. It was found that the lower the Si/Al ratio the higher the enhancement factor (EF). The formation of surface streamer became less as the Si/Al ratio increased. The possible mechanism on these observation will be discussed.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-5

Title:

Fundamental study on ammonia generation using packed bed　electric discharge

Affiliation:

Dept. of Environment and Life sciences, Toyohashi University　of Technology

Author(s):

○Tomohiro Shimoda, Hideaki Hayashi, Hirofumi Kurita, Kazunori　Takashima and Akira Mizuno

Abstract:

We examined ammonia generation from N2 and H2 using packed bed electric discharge. We showed NH3 production was possible at atmospheric pressure and room temperature. Moreover, the highest ammonia concentration was observed when the mixture ratio of N2 and H2 was 3:1. In this case, the production efficiency was 0.36 g/kWh under the condition of 0.0167 sec of discharge area retention time. Improvement of the ammonia production can be expected by optimizing the experimental condition.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-6

Title:

Evaluation of catalytic electrical conduction with an AC impedance method for catalytic reaction in plasma

Affiliation:

WASEDA University

Author(s):

Kazumasa OSHIMA・Yoshitaka TANAKA・Tatsuya SHINAGAWA・○Yasushi SEKINE

Abstract:

We evaluated the electrical conductivity of the catalyst on the catalytic activity for two reactions: oxidative coupling of methane or steamreforming of methane in an electric field (Electreforming), with using an AC impedance method. In order to apply the electric field on the catalyst,suitable electrical conductivity of the catalyst was required. On lowelectrical conductivity catalyst, spark discharge was generated, and on catalytic activity was not shown on high electrical conductivity catalyst.From our work, even an electrical insulant catalyst, doping other cationgenerated the electrical conduction career, and increased the electrical

conductivity enough for applying the electric field. And we found that high mobility of the lattice oxygen-ion decreased the formation enthalpy of the oxygen-ion vacancy, and derived high catalytic activity in the electric field. Furthermore, we developed the impedance analysis in other catalytic reaction including the lattice oxygen, and found that thelattice oxygen contributed the reaction electrochemically.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pB-7

Title:

Measurement of OH Radicals Density in Atmospheric Pressure Plasma for Medicals Application Using Nanosecond Pulsed Power Generator

Affiliation:

Author(s):

Abstract:

OH distribution as two-dimensional images was observed with Laser Induced Fluorescence method. OH as one of strongest oxidant was generated by nano-seconds of pulsed power voltage between metal-water electrodes in order to biomedical and surface treatment applications. The two dimensional images were taken by a gated-ICCD camera with frequency filter for OH fluorescence. The distribution emphasized OH density locally increase on the surface due to surface discharge.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pC-1

Title:

Solubilization and Refolding of Inclusion Body Protein by Pulsed Electric Field Treatment

Affiliation:

Dept. of Environmental and Chemical Eng., Gunma University

Author(s):

Takanori TANINO, Kazuki SAKAI, Takayuki OHSHIMA

Abstract:

Solubilization and refolding profiles of inclusion body proteins by pulsed electric field (PEF) treatment were investigated using enhanced green fluorescence protein (EGFP) and Candida antarctica lipase B (CALB) as the model proteins. EGFP inclusion body was successfully solubilized by PEF treatment and the percentage solubilization was increased with the increase of the initial insoluble protein concentration. The soluble protein concentration 269 mg/ml and percentage solibilization 5.5% were obtained by the 20 min PEF treatment in 3 mg/ml initial insoluble protein suspension. Fluorescence of EGFP that indicating refolding of EGFP protein was detected in the solubilized protein fraction. CALB inclusion body was also solubilized by PEF treatment. However, percentage solubilization was low and decreased with the increase of initial insoluble protein concentration. And solubilized protein did not show the lipase activity. Addition of surfactant (0.1% triton-X100) to CALB inclusion body suspension synergistically increased percentage solubilization by PEF treatment. The percentage solubilization 7.4% was obtained by 8 min treatment, and lipase activity was also detected in the solubilized protein solution. Increase of the PEF applied voltage increased percentage solubilization slightly and shorten the treatment time to obtain maximum solubilization percentage.

Program number:

13pC-2

Title:

Fluorescent analysis of plasma-treated Bacillus subtilis spores genetically labeled with GFP-fused coat proteins

Affiliation:

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

Author(s):

○Yuuki TANI＊、Hachiro YASUDA＊、Daisuke IMAMURA＊＊　Hirofumi KURITA＊、Kazunori TAKASHIMA＊、　Kazuhito WATABE＊＊、 Akira MIZUNO＊

Abstract:

Sterilization of bacteria using atmospheric pressure electric discharge plasma has been studied extensively. However, the mechanism of bacterial inactivation caused by the plasma is poorly understood. We have constructed a series of Bacillus subtilis strains whose spore coat is labeled with green fluorescent protein (GFP) by fusing GFP to proteins involved in spore coat assembly. We analyzed one of the construct whose lipoprotein YhcN is fused with GFP, and location of GFP fluorescence in the spore is limited to inner membrane and cortex. In the course of plasma application to the GFP-fused spores, decrease of GFP fluorescence preceded cell inactivation. It is suggested that the damage by the plasma starts from the surface of the spore and proceeds inside gradually, and finally leads lethal destruction of the spore core.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pC-3

Title:

Investigation of Temporal Relationship between Dielectrophoretic Velocity and Damage Rate for Heat Treatment Yeast

Affiliation:

Tokyo Metropolitan Univ

Author(s):

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

Abstract:

Constant monitoring and immediate control of fermentation processes have been required for advanced quality preservation in food and biomass industries. In the present work, the change in metabolic states for injured Saccharomyces cerevisiae (yeast) with heat treatment was investigated using Dielectrophoretic velocimetry in a microcell. We obtained DEP velocity for damage state of yeast quantitatively. There was strong relationship between the average DEP velocity and damage rate of yeast. These results suggest that DEP velocimetry will be available for direct estimation of metabolic states.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pC-4

Title:

Evaluation of painted surface using a non-contact surface resistivity measurement

Affiliation:

Graduate School of Science and Engineering, Yamagata University

Author(s):

Kohei　YAMAGUCHI

Abstract:

It is necessary to optimize painting parameters in spray painting processes such as air pressure of the spray gun, distance between the target and the gun, velocity of the gun motion and so on. In this research, the surface potential of the sprayed target charged by corona discharge was measured to characterize the spray coated surface. The surface potential was found to be related to the initial thickness of the paint, and the degree of curing because of the charge in the surface resistivity due to the evaporation of solvents.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pC-5

Title:

Study on Improvement for the Ionic Microphone

Affiliation:

Department of Electrical and Electronic Engineering , Kanagawa Institute of Technology

Author(s):

Hiroshi AKINO

Abstract:

This study examined improvements for the RF discharge ionic microphone. RF discharge with a harmonic oscillator circuit configuration produces hot plasma. Change in frequency of oscillator for RF discharge corresponds to the sound wave.

However, it could not realize enough signal-to-noise ratio. Signal-to-noise ratio was improved by improving discharge electrode, FM demodulator and acoustic terminal. The response of the ionic microphone was in proportion to the particle displacement of the sound.

第 36 回静電気学会全国大会アブストラクト集

Program number:

13pC-6

Title:

Behavior of a Water Droplet under the Orthogonal Electric Field with Half Sinusoidal Wave

Affiliation:

Graduated School of Science and Engineering, Yamagata University

Author(s):

○Hiroshi Tenma，Takaki Ohuchi，Yoshio Higashiyama

Abstract:

A water droplet under AC electric field manifests a resonant vibration at certain frequency. In order to stir or mix water droplets by resonant vibration, behavior of a water droplet under the orthogonal electric field with half sinusoidal wave was investigated. Two half sinusoidal waves were applied to two pairs of orthogonal electrodes where a 100mL water droplet was placed on the insulating plate such as SiR, PTFE and super water-repellent HIREC plate.　A water droplet on HIREC plate was largely deformed by vibrating and rotating motion.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-1

Title:

Diesel Emission Purification by Dual Adsorbent Chamber Hybrid Aftertreatment System of NOx Recirculation and Reduction Using Nonthermal Plasma

Affiliation:

Graduate School of Engineering, Osaka Prefecture University

Author(s):

Harunobu Nakaguchi, Takuya Kuwahara, Tomoyuki Kuroki, Masaaki Okubo

Abstract:

Diesel emission is treated by dual adsorbent chamber hybrid aftertreatment system of NOx recirculation and reduction using nonthermal plasma because the regulation of diesel emission has been tighten recently. NOx in diesel emission is absorbed by absorbent and then desorbed with N2 gas by exhaust heat from an engine. Desorbed and concentrated NOx is reduced by N2 plasma. In cooling process, remaining NOx on adsorbent is desorbed with intake air and supplied to the engine, resulting NOx reduction. Adsorbent is regenerated by NOx desorption. By using two adsorbent chambers alternately, the system can achieve high efficiency NOx removal continuously. A stationary diesel engine generator with light oil is used in order to evaluate the performance of the system. As a result, 149 g/kWh of NOx removal energy efficiency is achieved when 64% of NOx is removed. Moreover, considering the regulation of diesel emission in Japan, post new long term regulation, our aftertreatment system achieves this regulation at 0.87% of engine power.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-2

Title:

Development of Super Clean Diesel Engine and Combustor Using Nonthermal Plasma Aftertreatment (Recent Achievements)

Affiliation:

Osaka Prefecture University

Author(s):

Masaaki Okubo

Abstract:

Catalytic aftertreatment technology for exhaust gas emitted from fossil fuel combustor or combustion engines is now approaching to a practical limit because the temperature of exhaust gases decreases with increase in the fuel combustion efficiency. Further, the prices of rare or precious metals are significantly increasing. Therefore, nonthermal plasma aftertreatment becomes more important in a near future. In this paper, our recent experimental achievements on plasma emission control for diesel engines and combustor is reviewed.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-3

Title:

Function of an electrostatic precipitator using bipolar corona discharges

Affiliation:

*Panasonic Ecology Systems Co., Ltd, 4017, Takaki-cho Kasugai-city, Aichi-pref., 486-8522, Japan, **Toyohashi University of Technology, 1-1, Hibarigaoka, Tenpaku-ku, Toyohashi-city, Aich-pref., 441-8580, Japan

Author(s):

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

Abstract:

The discharge spikes in the ionizer of the ESP (electrostatic precipitator) with bipolar corona-discharge are arranged not only in the energized-plates but also in the grounded-plates. The discharge from the spikes in the grounded-plates generates ions of opposite polarity to those from the energized-plates. A two-stage-type ESP with bipolar-corona discharge is composed of the ionizer and a collector to which DC high voltage is applied. In the previous test, this bipolar collection method, using positive and negative discharges simultaneously, has been proved to collect particles satisfactory. In this report, the patterns formed by the collected-particles on the ionizer-plates and the collector-plates have been discussed in order to clarify the charging-mechanism in the bipolar discharge.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-4

Title:

Investigation of charging electrode structure for improving energy efficiency in an electrostatic precipitator

Affiliation:

＊Kanagawa Institute of Technology ＊＊Fuji Electric Co., Ltd, ＊＊＊Tokyo City University

Author(s):

○Satoru OOI＊, Akinori ZUKERAN＊, Hitomi KAWAKAMI＊＊, Koji YASUMOTO＊＊, Yoshiyasu EHARA＊＊＊

Abstract:

Electrostatic precipitator (ESPs) have been extensively used for the cleaning of industrial process flue gases, combustion flue gases, and ventilation flue gases of buildings, etc., because of its high collection efficiency. However, it is important to improve the energy efficiency of ESP. In the present study, optimum grounded electrode length of the pre-charger was investigated to improve the energy efficiency of the two-stage type ESP using indoor air. The pre-charger consisted of a wire electrode and a grounded plate electrode. The spacing between the adjacent electrodes was 15mm. The collection efficiency as a function of the grounded plate electrode length of the pre-charger was estimated. The collection efficiency was calculated from upstream and downstream particle concentrations. The particle concentrations were measured using a particle counter. As a result, it was indicated that the optimum grounded plate electrode length was between 40 and 50mm for the energy efficiency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-5

Title:

Flow control and plasma oxidation of diesel particulate matter (PM) in an ESP

Affiliation:

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

Author(s):

○ Yuri Kawara, Shunsuke Morimitsu, Hideaki Hayashi, Hirofumi Kurita, Kazunori Takashima and Akira Mizuno

Abstract:

Diesel particulate matter (PM) exhausted from diesel engine during the combustion process cause environment impacts. Many methods have been applied for removal of the particles. An electrostatic precipitator (ESP) can collect nanosized particles at low pressure drop. However, the accumulated particles cause electrical breakdown. Therefore, treatment of the accumulated PM should be developed. To cope with this problem, localization of PM accumulation and oxidation of the PM by direct-current spark discharge with a floating electrode were investigated. Spatial distribution measurement of PM in a cylindrical ESP showed PM accumulated on a certain position and the position was controllable by applied voltage. In addition, we demonstrated that installation of a floating electrode between a discharge electrode and a collecting electrode can generate direct-current spark discharge between the floating electrode and the collecting electrode. Furthermore, oxidation of carbon particle was confirmed from a preliminary device. The simultaneous operation of PM collection and oxidation could be effective for stable operation of ESP.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-6

Title:

Particle removal near to 1 mg/Nm3 by electrostatic precipitations for Oxygen-Pulverlized Coal combustion

Affiliation:

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

Author(s):

＊Hak-Joon Kim＊, ＊＊＊, Bangwoo Han＊, Yong-Jin Kim＊, Jeong-Hee Hong＊＊, Kinam Kwon＊＊, and Tetsuji Oda＊＊＊ Environmental and Energy Systems Research Division, Korea Institute of Machinery and Materials (KIMM) ＊＊ KC Cottrell Co. Ltd.

Abstract:

The collection performance of the particle cleaning system composed of a 1000 m3/hr-dry ESP and a 400 m3/hr-wet ESP for 0.7 MW-Oxy PC combustion and CCS was tested under air- and oxy-firing combustion changing operation parameters of the ESPs. The wet ESP developed here had a thin water film on the collection plates with surface treatment by nano particle coating and sand blasting, only consuming a water of 1.5 L/min/m2. The test results showed that the corona current of a dry ESP reduced with the oxy-firing combustion, compared to the same applied voltage for air-firing combustion, but the collection performance of the ESP was linearly related to power consumption for the ESP, regardless of combustion condition. Also, the gravimetric concentration of particles near 1 mg/m3 was achieved by addition of the wet water film ESP to downstream of a dry ESP.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aB-7

Title:

Particle removal of a non-metallic ESP for particles and mist in corrosive gases from semiconductor manufacturing industries

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:

We have developed a novel non-metallic two-stage ESP that uses carbon brush chargers at the center of the grounded channels of carbon fiber reinforced polymer, and uses polyvinyl chloride collection plates into which metallic films are inserted. The collection performance of the ESP downstream of a wet scrubber with packing balls was evaluated with SiO2 and mist particles. The results showed that the electrical performance of the ESP (16 channels, 400 x 400 mm2) was maintained with different materials of the channels and decreasing the size to 50 mm. The ESP (16 channels with 100 mm length, 400 x 400 mm2 x 540 mm with 10 mm gap) removed more than 90% of SiO2 and mist particles with 10 kV and 12 kV applied to the ESP at 2 m/s and 3.6 L/m3. It was also found that the average collection efficiency of the ESP for one month at the demonstration site, 97 % based on particle number and 92 % on total particle mass, was achieved with a much smaller specific corona power of 0.28 W/m3/hr, compared to conventional ESPs.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-1

Title:

Dispersion Treatment and Measurement of Dielectrophoretic Property of Powdery Silver Nanoparticles

Affiliation:

Tokyo Metropolitan University

Author(s):

○Shin Yamazaki, Kosuke Hayami, Naoki Shirai, Satoshi Uchida, Humiyoshi Tochikubo

Abstract:

The assembly and alignment of metal-nanoparticles into functional structures is available for nanotechnology applications. Dielectrophoresis (DEP) is an atractive method for the manipulation of nanoparticles. In the present work, we treated powdery silver particles with ultrasonication and pulsed streamer to prevent aggregating, and measured the number of DEP trapping particles. We observed that the property of DEP varies depending on the conductivity of suspension and particle size. It is also demonstrated that there is difference of behavior of micro-particles from nano-particles. We qualitatively controlled the amount of silver particles trapped by dielectrophoresi changing applied frequency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-2

Title:

Evaluation of insulation deterioration for polymer insulator using electrostatic spraing

Affiliation:

Graduate School of Science and Engineering, Yamagata Uniersity

Author(s):

Hiro ADACHI

Abstract:

Partial discharge at the surface of the polymer insulator sometimes causes serious insulation deterioration. The quantitative evaluation of insulation performance of polymer insulator is necessary a performance of including a decrease in water repellency. An evaluation system for the insulation deterioration has been investigated focusing on the surface potential produced by the electrostatic spraying on the insulator. It was found that the surface potential produced by the spread water droplet on the insulator depends on the degree of the deterioration.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-3

Title:

A study on a simple voltage control method of high-voltage d-c power supply for corona discharge ionizers

Affiliation:

* Sendai National College of Technology,　** Shishido Electric, Ltd.

Author(s):

○M.Hattori*, J.Sugaya*, T.Oizumi*, T.Saito**, and K.Izumi**

Abstract:

In this report, based on the experimental results of a corona discharge ionizer, several problems are pointed out. First, for example, a high frequency piezoelectric transformer type contains extra current due to needle-to-ground capacitance besides the desired pure ion current. For this problem, a measuring method of the pure ion current was proposed by cancelling the disturbance current. Next a hybrid power supply which consists of a variable high voltage dc and low frequency ac power supply was proposed. This method has an advantage of easiness to measure pure ion current. To make this variable dc power supply, a Triac (a commercial semiconductor for ac power control) and Cockcroft-Walton circuits were used to adjust the ac voltage, using a new concept of phase control method named "π starting turn-on angle control method". It was clarified that this voltage control method is useful for corona discharge ionizers.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-4

Title:

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

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:

In general, static electricity is generated easily in the clean room environment, such as LCD manufacturing. Static electricity caused a production failure, and it has been become a problem for product yield loss. To solve this problem, the corona discharge ionizers have been widely used. However, because of particle deposited on the electrode, corona discharge ionizer is known to have been a source of particles. Therefore we have conducted to develop the sheath-air type ionizer preventing the particle deposition on electrode by covering electrode with high purity N2 gas. However, as the glass substrate of the LCD production line grew bigger, size of the ionizer became got longer, and a large quantity of high-purity N2 gas was necessary. So the new measures method to suppress particle generation was needed. In this paper, we report the results of the verification of inhibitory effect of particle generation by the electrode heating.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-5

Title:

Emitter Current Sensor for Measuring Ion Generation Rate of Corona Discharge Air Ionizer

Affiliation:

Department of Electrical Engineering, The University of Industrial Technology＊、Department of High Skills Training, CANON INC.＊＊

Author(s):

○Yasuna HIRATA, Sayuri YOSHIOKA, 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 areas; 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 lowest detective limit of the sensor was lower than 100 nA.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-6

Title:

Transportation Efficiency of Ions Generated by AC Corona Discharge Air Ionizer Effects of Frequency of Ion Transportation Efficiency of AC Corona Discharge Air Ionizer

Affiliation:

Department of Electrical Engineering, The University of Industrial Technology

Author(s):

○Nana IWAMOTO, Kazuo OKANO

Abstract:

Suppression of the particle generation from the emitter of the corona discharge air ionizer is one of the most important issues to maintain the clean room at low contamination level. The particle generation rate increases with increasing the ion creation rate, because the particles are generated by spattering effect of the generated ions. In order to find out the optimum operating condition by controlling the ion transportation efficiency, that is defined as the ratio of the ion number arrived at the working aria to the of ion number created at the emitter of the air ionizer, we investigated the relationship between the ion transportation efficiency and the frequency of the power supply as an operating condition of the air ionizer. The low frequency operation was suitable to suppress particle generation without reducing the static neutralization performance, because the ion transportation efficiency increased with decreasing the operating frequency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-7

Title:

Development of DC Type Explosion Protection Electrostatic Ionizer

Affiliation:

＊Kasuga Denki INC、＊＊JNIOSH

Author(s):

Tomofumi MOGAMI＊、Kwangseok CHOI＊＊、Teruo SUZUKI＊、Mizuki YAMAGUMA＊＊

Abstract:

As a method to prevent or mitigate electrostatic charge and/or discharges, we have developed a novel DC type explosion protection electrostatic ionizer. In this study, we evaluated experimentally the practical version of the novel ionizer with a modeling test system and a pneumatic powder transport facility. Four arranged novel ionizers were effective for the reduction of electrostatic charges on polypropylene granules and the suppression of incendiary discharges. This novel ionizer is expected to be very useful and reliable to prevent problems originating from electrostatic charges and/or discharges.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aD-8

Title:

Computational modelling of charge neutralization of insulators - Comparison with conductors

Affiliation:

National Institute of Occupational Safety and Health, Japan

Author(s):

Atsushi Ohsawa

Abstract:

We report a computational comparison of phenomena of charge neutralisations of insulators and conductors using 2-D cylindrical electrohydrodynamic modelling. The early-phase phenomena of the insulator charge neutralisation are complicated and significantly different from the conductor ones, which indicates that the evaluation by the standard test may lead to potential problems in practical applications. In addition, the results demonstrated that, in the insulator charge neutralisation, ionisers themselves can cause latent hazards during neutralisation. We propose proper use of ionisers and the standard test to avoid such hazards.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-1

Title:

Electromagnetic fields due to electrostatic discharges and their specific characteristics

Affiliation:

Nagoya Institute of Technology

Author(s):

Osamu　Fujiwara

Abstract:

Before the concept of electromagnetic compatibility (EMC) was established in the Unite States of America more than fifty years ago, electrostatic discharges (ESDs) had already been known as an electromagnetic noise source, and nowadays still become one of significant EMC subjects to be solved. This implies the necessity of a breakthrough in dealing with ESD issues .In this paper, some of the findings on ESD fields and their specific characteristics this author derived so far were shown along with an FDTD simulation based on a spark-resistance formula.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-2

Title:

Electrostatic Charge and Discharge

Affiliation:

*School of Engineering, The University of Tokyo

Author(s):

Tetsuji Oda

Abstract:

The electrostatic charging and discharge are most essential factor for the electrostatic problems in many field including industrial side. Charging mechanism and electrostatic discharge (ESD) phenomena are discussed. Recent low voltage ESD phenomena are also introduced. High frequency oscillation by tunneling effect is also discussed as future trouble by ESD. At low voltage, gas ionization is negligible but contact discharge must be discussed.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-3

Title:

Precise measurement technique of ESD fields in time domain

Affiliation:

National Institute of Information and Communications Technology

Author(s):

○Shinobu ISHIGAMI, Ifong WU, Kaoru GOTOH and Yasushi MATSUMOTO

Abstract:

This paper describes the time-domain measurement and waveform reconstruction technique of the electromagnetic fields emitted by an electrostatic discharge using a complex antenna factor of a detecting antenna (sensor) and observed waveform with an oscilloscope. The Fourier transforms and its application for the field-waveform reconstruction are outlined.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-4

Title:

Effects of Grounded Ring of Corona Discharge Air Ionizer on Static Neutralization Performance

Affiliation:

Department of Electrical Engineering, The University of Industrial Technology

Author(s):

Sasika COORAY, ○Kazuo OKANO

Abstract:

We deal with effects of the grounded ring of the air ionizer on the static neutralization performance. The relationship between the emitter voltage and the neutralization current were measured with varying the radius of the grounded ring. The threshold voltage of the air ionizer was slightly increased with increasing the radius. The neutralization currents of the air ionizer with larger grounded ring were higher than that with smaller one, at high voltage operation. The air ionizer without a grounded ring showed the highest current at high voltage operation.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-5

Title:

The strength and directivity of electromagnetic radiation due to low voltage ESD

Affiliation:

Hachinohe Institute of Technology

Author(s):

Ken Kawamata

Abstract:

The strength and directivity of electromagnetic radiation due to low voltage ESD was examined in experimental study. In this time, we present an experimental system to measure the electromagnetic radiation in wideband region using spherical electrodes and a horn antenna. As a result, the strength of electromagnetic radiation is proportion to the charged voltage from 300V to 620V and diameter of the electrode. Directivity of electromagnetic radiation in spherical electrode shows similar pattern like a dipole antenna configuration.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-6

Title:

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

Affiliation:

1 Suzuka National College of Technology, 2YUKA DENSHI CO.,LTD

Author(s):

Takayoshi Ohtsu, Hideyuki Doyama, Kouichi Sagisaka

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 of a carrier case for the device and the case for a system. In this study, the polycarbonate with CF (carbon fiber) , the polycarbonate with CNF (carbon nano fiber) and the polycarbonate with 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 36 回静電気学会全国大会アブストラクト集

Program number:

14aSS-7

Title:

A Consideration of the Simulation method of ESD Stress on the Print Circuit Board

Affiliation:

Tokyo Institute of Science

Author(s):

Takahiro YOSHIDA

Noriaki MASUI

Abstract:

It is desirable to simulate electrostatic discharge (ESD) tolerance and immunity of electronics and semiconductor devices in advance because this pre-test method will achieve shortening of the development period and reduction of development cost. In this study, we acquired the ESD source model of an ESD gun which reflects real ESD characteristics and the electrical transmission line model using s-parameters measured by vector network analyzer. In addition, we tested the ESD stress simulation by combining these models in the RF electrical circuit simulator. From the comparison of the measured and simulated voltage waveform, we found that shape, peak voltage, and duration of ESD stress's voltage waveform at the integrated circuit (IC) input pin is successfully simulated by these modeling and simulation method.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-1

Title:

Regeneration of diesel particulate filter using sliding　discharge

Affiliation:

Dept. of Environmental and Life Sciences, Toyohashi University of Technology

Author(s):

○Takashi Yamaji, Hideaki Hayashi, Daisuke Sakiyama, Kazunori Takashima and Akira Mizuno

Abstract:

Diesel particulate filters (DPF) haves been established as a key technology in reducing diesel particulate emission. A　DPFconsists a porous ceramic filter, and collected PM is oxidized for regeneration. In order to regenerate a DPF, temperature must reach 600℃, and there is a possibility of thermal damage. Therefore, a novel low-temperature regeneration technology　has been required. In this study, regeneration of DPF using non-thermal sliding discharge has been investigated. In order to generate a sliding discharge inside a DPF surface discharge is generated at one end of a DPF and a DC electric field is applied across a DPF. As a result, it was confirmed thatthe PM was oxidized by the sliding discharge. In addition, the PM oxidation efficiency was improved with increasing AC high voltage for the surface discharge and with raising the temperature during the discharge. It showed around 11 g/kWh ofthe PM oxidation efficiency. In order toimprove PM oxidation efficiency, silver was coated on the DPF. As a result, it showed around 16 g/kWh of the PM oxidationefficiency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-1

Title:

Evaluation of TiO2 Film for Dye-Sensitized Solar Cell Produced by Electrostatic Atomization

Affiliation:

College of Industrial Technology, Nihon University

Author(s):

○Shota YAZAWA, Yusuke SASAGAWA, Yusuke KUDO

Abstract:

In this study, it was investigated that producing the TiO2 film for dye-sensitized solar cell by electrostatic atomization method. This method can change atomization only by changing the applied voltage. It was thought that an appropriately surface structure was able to be produced. As a result, the solar cell produced by the applied voltage -5.0 kV showed the best power generation efficiency.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-2

Title:

Application of atmospheric non-thermal plasma in emission control of diesel vehicle---Possibility and problems

Affiliation:

Dept. of Environment and Life sciences, Toyohashi University of Technology

Author(s):

○Hideaki Hayashi, Hirofumi Kurita, Kazunori Takashima and Akira Mizuno

Abstract:

Atmospheric non-thermal plasma has been recognized as an important basic tool for promoting various chemical reactions at low temperature. Non-thermal plasma has potentially a wide range of applications, including environmental and biological fields, such as removal of NOX and soot in diesel exhaust. In this paper, recent progress of our study using non-thermal plasma for emission control from diesel vehicle is introduced.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-2

Title:

The improvement of dye-sensitized solar cells using ultraviolet light

Affiliation:

The University of Tokyo　Department of Advanced Energy Oda Ono lab

Author(s):

Zen shungo

Abstract:

Dye-sensitized solar cell (DSSC) requires sintering of TiO2 paste at 450-550 ℃ to be manufactured. The high-temperature sintering is disadvantageous because it limits use of materials which cannot resist high temperature. In our previous study, we develop a new technique to reduce the sintering temperature using dielectric barrier discharge (DBD) treatment. To identify the cause of DBD treatment, we use ultraviolet (UV) treatment in this paper. As a result, UV treatment has the same effect of DBD treatment. Because UV treatment can be combined with DBD treatment, this technique can improve our previous study.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-3

Title:

Studies on simultaneous measurement of mass and charge of raindrops

Affiliation:

Kanagawa Institute of Technology

Author(s):

Abstract:

The purpose of this study is to construct a system of simultaneous measurement of the amount of charge and mass of raindrops. It was tried that the charge of raindrop is evaluated from the current waveform which arose , when the raindrop collided with metal film, and at the same time the mass of raindrop is evaluated from the response of the condenser microphone for the shock wave in the collision. It would be possible to avoid the problem of drift in this thing.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-3

Title:

Characteristics of Complete Regeneration of Diesel Particulate Filer Using Indirect Plasma

Affiliation:

*Department of Mechanical Engineering, Osaka Prefecture University

Author(s):

○Takuya KUWAHARA*, Shunsuke NISHII*, Tomoyuki KUROKI* and Masaaki OKUBO*

Abstract:

In recent years, the regulations governing diesel engine emissions become more stringent. It is difficult to fulfill these requirements by means of combustion improvement alone. Although an indirect plasma method for regenerating a diesel particulate filter (DPF) draws attention as an innovative technique, it is unknown that this technique can achieve a complete DPF regeneration, that is, all collected particulate matter (PM) can be oxidized by nonthermal plasma-induced ozone. In this study, we investigate a possibility of a complete DPF regeneration by evaluating pressure differences between inlet and outlet of DPF. As a result, a complete DPF regeneration can be achieved with an ozone injection of 34.8 g/h for 2 hours after collecting PM in the DPF for 2 hours. The series of the PM collection and the DPF regeneration are performed without stopping engine operation.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-4

Title:

After Treatment of Particulate Matters in Diesel Exhaust -Synergy Effect of Non-thermal Plasma and Catalyst-

Affiliation:

SETEC Co. Ltd

Author(s):

○ Yoji NAKAJIMA and Hiroshi SETO

Abstract:

By using an electrostatic precipitator with DBD (Dielectric Barrier Discharge), model devices for the PM abatement were assembled to reduce back pressure caused by conventional DPF (Diesel Particulate Filter) and to simplify the regeneration process of the DPF. Three devices were successively contrived for improvement, but the first two devices were quite unsatisfactory, except for the collection efficiency of solid particles. The major components of PM are soot and SOF (Soluble Organic Fraction). Although PM is the an abbreviation for Particulate Matters, it was found that most fraction of SOF took gaseous phase at the elevated temperature in the device, and therefore a considerable amount of SOF slipped though the dust collection zone of the device. To oxidize SOF by plasma, several forms of DBD electrodes were tested and improved. And finally, we found that a combined use of DBD and catalyst was very effective. It worked at low temperature, say, around 100 degrees in Celcius. As a result, the exhaust gas from a diesel generator, for which emission control was rather lax, was cleaned up to the level of recent Japanese regulation for heavy-duty diesel vehicles, i.e., 10 mg/kWh.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pB-4

Title:

Preparation of platinum nano-sized planer networks using low energy electron beams

Affiliation:

＊Japan Atomic Energy Agency ＊＊ Saitama Institute of Technology

Author(s):

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

Abstract:

Water solution containing 1 mmol/L PtCl42- ions and 0.5-20v% ethanol was irradiated with low energy electron beams. Production of planar networks was observed on the surface of the irradiated solution. Rutherford backscattering spectrometry and X-ray photoelectron spectroscopy demonstrated that the planar networks consisted of metal platinum and their production was accelerated at lower ethanol concentrations. Transmission electron microscope observation suggested that Pt particles with sizes of 2-5 nm are produced through reduction of PtCl42- ions at the surface of the solution. These Pt particles coagulated each other to form planar network.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pD-1

Title:

Raman spectroscopy of molecule densities in hydrogen-air flame kernel genarated by spark discharge with high-spatial resolution

Affiliation:

Department of Advanced Energy, Graduate School of Frontier Sciences, Divison of Transdisciplinary Sciences, The University of Tokyo

Author(s):

Ayumi Kumamoto

Abstract:

For investigating the electrostatic ignition process of hydrogen-air mixture, the densities and dynamics of H2, N2 and H2O molecules are measured in a spark-ignited hydrogen-air mixture using Raman spectroscopy. A KrF excimer laser (248 nm) is used for the Raman spectroscopy.

We measured molecules in Hydrogen-air mixtures with 30% H2 are ignited with a capacitive spark discharge. It is shown that H2 density decreases with time after the spark ignition, while H2O density increases, as expected.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pD-2

Title:

Investigation of safety for tracking resistance plug

Affiliation:

KOGAKUIN UNIVERSITY

Author(s):

○Shota YUYAMA, Norimitsu ICHIKAWA and Tetsuo SAKAMOTO

Abstract:

A fire by tracking is generated occasionally. The cause of tracking is the existence of a dust of space between an electrical outlet and a plug. Spark discharges at the space covered with dust are generated when the dust absorbs moisture. A fire caused by tracking is generated by changing the isolated surface between plugs into a carbonized surface. This type of fire of 35 cases occurred at the first half of 2011 in Japan. Such fire occurs in the hidden electrical outlet. Therefore, the determination of the fire, whether the fire occurs, is not so easy in the early stages. The tracking resistance plug is recently used for preventing the fire in Japan. The experimental objective is to study experimentally the safety of tracking resistance plug. In this paper, we study the difference between an tracking resistance plug and a non tracking resistance plug. The experiments are carried out when aqueous solution is dripped between the electrical outlet and the plugs with dust. The result shows this plug does not completely prevent the tracking.

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pD-3

Title:

A risk assessment of electrostatic discharge (ESD) from an ungrounded hose-coupling in paint circulation system

Affiliation:

ABB

Author(s):

Yukio YAMADA

Abstract:

In automotive production, a line uses many paint circulation systems to keep the paint quality and to avoid separating paint elements such as color pigment, radiant materials and filler. The paper evaluates a risk assessment of electrostatic discharge from a small, electrically ungrounded, hose-coupling which is applied to paint circulation system. The result shows one of the big risks comes from changing the isolate distance between the paint plastic hose with the ungrounded hose-coupling and the grounded wall. Pressure ripple of the paint transport system makes mechanical vibration that can possibly change the isolated distance, therefore, care should be taken to avoid this risk by properly ground the hose-coupling

第 36 回静電気学会全国大会アブストラクト集

Program number:

14pD-4

Title:

Development of a ESD source position visualization technology (Part 1)

Affiliation:

＊Kagoshima Prefectural Institute of Industrial Technology, ＊＊NIPPON KEIKI KAGOSHIMA Co., Ltd.

Author(s):

○Hiroshi ONOMAE＊, Masaaki KATO＊＊, Kakutaro NAKA＊＊

Abstract:

We developed the technology which visualizes an ESD source on a video image. This visualization System is constructed by four receiving antennas, one video camera, one sampling digital oscilloscope, and a Control PC. This system detects an ESD source position accurately by the hyperbolic method. By visualizing an ESD source, the analysis of ESD phenomenon becomes easy.