2014 Annual Meeting of The Institute of Electrostatics Japan
Hiroshima International University
September 8-9, 2014

8aA-1

September 8th (Mon.), <10:00-12:00>
Room 1

Helix-Sense Inversion of Poly(β-Phenethyl L-Aspartate) and Piezoelectricity.

○Kazuhiro TANIMOTO*,***, Nariaki ITO**, Kouki SHIBATA**, Hidemine FURUYA**, Akihiro ABE**, Hisayoshi NISHIZAKI*, Teruyuki TADA*, Yuki SHIOMI*, Munehiro DATE****, Eichi FUKADA**** and Yoshiro TAJITSU*

*Graduate School of Engineering, Kansai University **Mitsui Chemicals, Inc.
***Graduate School of Science and Engineering, Tokyo Institute of Technology
****Kobayashi Riken

Abstract:

It has been reported that poly(β-phenethyl L-aspartate) (PPLA) exhibits irreversibly inversion from right-handed to left-handed helixes in a solid state at 130-140 °C. On the other hand, semicrystalline chiral polymers show shear piezoelectricity. We measured the temperature dependence of piezoelectricity of PPLA film. As a result, PPLA showed shear piezoelectricity and sign inversion of the piezoelectric constant at approximately 140 °C. Our results imply that the orientation was maintained after the sign inversion.

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Room 1

High Piezoelectirc Performance of Poly(lactic acid)Film Manifactured by Solid State Extrusion and the High-order Structure by POM Observation

○Mitsunobu Yoshida*, Takayuki Onogi*, Katsuki Onishi*, Hideyuki Sugitani, Teruyuki Tada, Syota Hayashi, and Yoshiro Tajitsu*

○*Mitsui Chemicals Inc., **Graduate School of Engineering, Kansai University

Abstract:

Recently, the development of a speaker, an actuator, and a pressure sensor using a piezoelectricity of uniaxial stretching poly(L-lactic acid);

(PLLA) film has been progressed. However, the shear piezoelectric constant d14 of a conventional uniaxial stretched PLLA film is 6-10pCN-1 that is somewhat insufficiency for the applications. Therefore, further improvement is desired. In this study, we carried out solid-state extrusion (SSE) to stretch and orient poly(D-lactic acid) (PDLA) and verified its effects on piezoelectric performance. By using the SSE, we succeeded in increasing the piezoelectric constant of PLLA to 20 pCN-1 or more. And we investigated high-order structure of stretched film by polarization microscope (POM).

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Room 1

Recharge of Electret Filter after Washing by Triboelectric Charging

○Yasuhiro NAKAMURA, Yasutaka INANAGA and Koji OTA

Mitsubishi Electric Co. Advanced Technology R&D Center.

Abstract:

Privately held

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8aA-4

September 8th (Mon.), <10:00-12:00>
Room 1

Thermal Endurance of Nano-composite Insulating Material of LDPE and Al2O3 Composed by Mixed Addition with Azobenzoic compound,

Yoshiaki Yamano

Faculty of Education Chiba University

Abstract:

This report presents test results after 5200 h from the start of thermal endurance test (aging test) on an insulating material of nano-composite with mixed addition. The nano-composite with mixed addition is originally designed to obtain a basic concept for long term endurance to electrical treeing deterioration. The composite was prepared by a mixed addition of azobenzoic compound and Al2O3 nano-particle into LDPE. 4'-hydroxyazobenzene-2-carboxylic acid (‘hc_Ab’) was chosen as a candidate. Experimental results with test materials before the aging test showed that an incubation time from voltage application to tree appearance was almost 1000 times longer than that for the base polymer under the constant applied voltage. The aging test is carrying out under temperatures, 87 °C, 92 °C and 95 °C. Properties for evaluations of the endurance are change in weight, resistance, UV absorption characteristics, etc. After 5200 h from the start of the aging, a change of 0.5 % in weight was detected with the mixed addition stored at 92 °C. By contrast, the change of the basic polymer was 2 %. The incubation time of the mixed addition was kept almost unchanged by the aging of

5200 h. The other properties with the test material were not reached to the end points which were defined in IEC 60216.

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Room 1

Study on the Dielectric Properties of Composite Materials

○Sou KATOU*, Hanzhi YANG*,Mahmudul KABIR*,Masafumi SUZUKI*Miyuki OGISHIMA**,Akihisa KUWAKI**

*Graduate School of Engineering and Resource Science Akita University,
**SWCC SHOWA CABLE SYSTEMS CO., LTD.

Abstract:

This research work deals with the dielectric properties of composite materials made of epoxy resin and ZnO micro varistors. We measured the dielectric properties of the samples with temperature and humidity. The dielectric permittivity of the samples was calculated and we found that not only the temperature rise but also the change in humidity is responsible of changing the dielectric permittivity of the composite materials.

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September 8th (Mon.), <10:00-12:00>
Room 1

Making of Rotation Symmetry Equivalent Circuit Model and Study of Loss Current at Low Growth of Water Tree

○Yuta SAITO, Masafumi SUZUKI

Graduate School of Engineering and Resource Science

Abstract:

in this study, we made a rotation symmetry equivalent circuit model of XLPE sheet degraded by water tree. Since the number of partitions was well enough for the above sheet, the circuit can evaluate even the 10% growth of water tree in the sample. Gradually, the loss current at low growth of water tree was analyzed. As a result, the peak value of the third harmonic current was found increased but delay in phase was found at the same harmonic current with the growth of water tree.

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8aA-7

September 8th (Mon.), <10:00-12:00>
Room 1

Corona Discharge from a Water Droplet without Disruption Formed at a Tip of a Capillary Tube

○Takuya Nakajima, Yoshio Higashiyama

Graduated School of Science and Engineering, Yamagata University

Abstract:

Current waveform of negative corona discharge from a water droplet formed at a capillary electrode consists of the repetitive pulse groups due to repetitive formation and disruption of a Taylor cone. Occurrence frequency of pulse group would be governed by vibrating frequency of a tip of the droplet during corona discharge. Disruption of the water droplet appears as the large first pulse in a pulse group. The waveform without the first pulse in each pulse group was accidentally observed. This means that and disruption of a Taylor cone would never occur. The vibrating frequency of a water droplet during corona discharge involving without the large first pulse in a pulse group varies from 2 to 4kHz and is strongly affected by an applied voltage, while corona discharge involving with the first pulse keeps almost constant at around 2kHz independent of the magnitude of applied voltage. Although the height of the corona pulse group without the first large pulse is a fourth or fifth of that with the first pulse, the charge quantity released during a single pulse group in both corona discharge aspect is almost the same.

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Room 1

Current waveform and electric charge in electrostatic spraying

Kazumasa CHIKU and Hirofumi SHIMOKAWA

Kanagawa Institute of Technology

Abstract:

In this study, current waveform detected in the electrostatic atomization by the nozzle was made to synchronize with the image of high-speed camera. The change of the process of the electrostatic atomization phenomenon is observed from the synchronization, and the electrification process is revealed. The electric charge required from pulse current form in dependent on the value of applied voltage and the polarity. The electric charge decreased with the voltage in tap water, and it increased with the voltage in the pure water. It's considered that the electric charge got from current waveform does not agree with electric charge of the droplet.

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8pA-2

September 8th (Mon.), <15:00-16:45>
Room 1

Behavior of a Viscous Water Droplet on a Super-Hydrophobic Plate under Three-Dimensional Electric Field

○Takaki Ohuchi, Yoshio Higashiyama

*Graduated School of Science and Engineering, Yamagata University

Abstract:

Electrostatic non-contact mixing of a water droplet placed on a super hydrophobic plate was investigated using a resonant vibration under an AC field with a definite frequency. Three-dimensional electric field was employed to enhance liquid flow inside a water droplet and to stir or mix water droplets by irregular vibration as well as resonant vibration. Sinusoidal waves with resonant frequency of 10Hz were applied to a pair of semispherical electrodes and to a electrode located above a 100mL water droplet placed on super-hydrophobic plate coated with HIREC. The deformation rate of a viscous water droplet with a viscosity from 0.9 to 29 mPa･s was measured from the images taken by a high-speed video camera. Under the three-dimensional AC electric field, a water droplet was largely deformed during resonant vibration, especially in the vertical direction due to the presence of vertical field. The deformation rate in the vertical direction of a distilled water droplet with a viscosity of 0.9 mPa･s was 1.8, while a viscous water droplet with 29 mPa･s was 1.3. The mixing performance of a viscous droplet should be confirmed by this system.

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September 8th (Mon.), <15:00-16:45>
Room 1

Electrification and division of the electrified water droplet on the super hydrophobic surface

○Yusuke FUTAMI and Hirofumi SHIMOKAWA

Kanagawa Institute of Technology

Abstract:

In the previous report, in which dropped on the hydrophobic surface of the silica type, the droplet was charged negatively, and small ejected droplet was charged positively. In addition, the hydrophobic surface was charged positively. In this report, charging droplet was dropped on the hydrophobic surface of the silica type. As the result, the surface was charged positively and small ejected droplet was charged positive. But, when the water droplet with greatly negatively charge was dropped, small ejected droplet was charged negatively.

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September 8th (Mon.), <15:00-16:45>
Room 1

The discharge characteristics by RF burst plasma using plasma-based ion implantation

○Nobuyuki FUJIMURA, Hiromitsu NOGUCHI, Kazuhiro SHIMONO, Hiroshi TOYOTA and Takeshi TANAKA

Hiroshima Institute of Technology

Abstract:

Plasma-based ion implantation (PBII) is a technique used to modify the surface of samples by immersion in plasma and application of a negative bias voltage to the target. In the PBII method, an ion and a radical are produced by applying a negative pulse voltage to an item and the reaction by it inactivates bacteria spore. Method of generating plasma using PBII has only self-ignited plasma or combination of self-ignited plasma and RF burst plasma. In this study, the authors examined the plasma generation method of RF burst plasma. The results, RF burst power required for the plasma generation becomes lower as the pressure increases.

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8pA-5

September 8th (Mon.), <15:00-16:45>
Room 1

Vibrational energy relaxation in atmospheric pressure streamer discharge

Department of Electrical Engineering, Tohoku University

Department of Electrical Engineering, Tohoku University

Abstract:

Behavior of vibrationally excited molecules in atmospheric pressure streamer discharge is discussed. Streamer discharge is simulated with our previously developed axis-symmetric 2D model and production and decay processes of vibrationally excited molecules of nitrogen, oxygen, and water molecules are calculated by vibration-to-translation (V-T) and vibration-to-vibration(V-V) reactions. Over the 70% of discharge energy goes to vibrational energy mode of nitrogen and the energy does not reach equilibrium until 100us in humid air.

This may affect the kinetics of high repetition rate discharge.

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8pA-6

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Room 1

The Motion of the Electron in Atom

○Seishu SHIMAMOTO and Yoshio TAKEMOTO

Department of Mechanical and Electrical Engineering, Nippon Bunri University

Abstract:

We derive the electron's equation of motion in atom from the modified Maxwell equation. Furthermore, we work towards improvements for the Bohr atomic model by using of this equation of motion. The relativistic energy in the orbit of the electron in atom is numerically calculated. The calculation result shows that the similarity between the Planck constant and the angular moment. These results strongly suggest the existence of the relation between the surrounding frequency energy, surrounding frequency and the angular moment.

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8aB-1

September 8th (Mon.), <10:15-12:00>
Room 2

Adsorptive removal of the underwater cesium ion by a combination of zeolite and high voltage application

○Yudai TAKEDA, Yuki TAINO, Takuma SUGANO, Hirofumi KURITA, Hachiro YASUDA, Kazunori TAKASHIMA, Akira MIZUNO

Department of Environmental and life Sciences, Toyohashi University

Abstract:

137Cs is one of the most dangerous radioactive materials due to its long half-life period of approximately 30 years. Efficient removal of the cesium ions in water is strongly required. Here, rapid removal of cesium ions by applying pulsed high voltage to zeolite was carried out. Since cesium ions are positively charged, they are driven by the electric field. The result showed that when we applied the voltage, the removal efficiency of the cesium ion increased, and total amount of absorbed cesium ions was also increased. Removal rate and effect of voltage application increased with decreasing Cs+ concentration, suggesting that this method can be effective for low-concentration cesium chloride solution like contaminated water from Fukushima NPP.

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8aB-2

September 8th (Mon.), <10:15-12:00>
Room 2

Influence of discharge parameters on the inception voltage of positive streamers in water

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

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

Abstract:

The influence of the applied voltage, gap distance, capacitance, and water conductivity on the inception voltage was investigated when a single-shot pulsed positive voltage with a duration of 10 μs was applied to a needle electrode with a tip radius of about 40 μm in water. The experimental results suggest the existence of threshold electric fields for both primary and secondary streamer inceptions. However the propagation velocity of primary streamers was constant regardless of the field strength as well as the gap distance, capacitance, and water conductivity.

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8aB-3

September 8th (Mon.), <10:15-12:00>
Room 2

Effect of Grounding Electrode Length on Corona Discharge in Electrostatic Precipitator

Yoshihiro Kawada*, Hirotaka Shimizu*, Satoru Ooi**, Akinori Zukeran**

*Polytechnic University, **Kanagawa Institute of Technology

Abstract:

Electric Precipitator are used for various industries, for example, coal boiler, clean room, road tunnel, air cleaner at home, due to improvement air environment. Operations of Electrostatic precipitator are suspended particles are charged with corona discharge section, charged particles are moved with electric field and collected on collector electrode. Almost power consumption of electrostatic precipitator is occurred at corona discharge section. In this paper, present type electrostatic precipitator is used two-stage type, consist of Pre-charger (corona discharge section) and Collector (electric field section). This paper focuses on the grounding electrode length of corona discharge from compact and low power consumption, thus, the effect of particle charge and particle collection efficiency with grounding electrode length are considered. We verified the grounding electrode length by numerical methods and experimental methods. As results, it has been shown that suitable grounding electrode length of corona discharge for particle collection efficiency. Electric field strength near with high voltage applied wire electrode is influenced with grounding electrode length. Thus, it is effect on corona discharge current with suitable grounding electrode length. Penetrated particles in corona discharge are charged. Hence, collection efficiency depends on grounding electrode length of corona discharge in pre-charger.

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September 8th (Mon.), <10:15-12:00>
Room 2

Electrostatic Precipitator Utilizing Gradient-force －
State of Collected Particles on Pole-plates －

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

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

Abstract:

lthough electrostatic precipitators (ESPs) charge particles which are passing through corona-discharge space and collect them by Coulomb's force, the authors have thought that the power consumption in ESPs might drastically be decreased if particles could be charged "without using corona-discharge". To verify this idea, the authors have tried an experiment as follows. i.e. DC high voltage was applied to a one-stage ESP composed of parallel flat-plates without corona discharge-spikes. This ESP does not generate corona discharge but does form non-uniform electric field of 8 kV/cm. The ESP was operated for 18 h under the diesel-exhaust gas-flow condition of 9 m/s. After the exposure to diesel exhaust, the electrode-plates of the ESP were observed. The result showed that the ESP collected particles on the electrode-plates without corona discharge. From the analysis of the vestiges on the plates, the gradient-force is working for the particle charging. This study implies the possibility of ESPs without using corona discharge to minimize the electrical power consumption.

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8aB-5

September 8th (Mon.), <10:15-12:00>
Room 2

Pilot-scale Experiment of Wet-type Exhaust Gas Treatment for Glass Melting Furnace Using a Plasma-chemical Hybrid Process

○Hashira YAMAMOTO*,**, Tomoyuki KUROKI*, Hidekatsu FUJISHIMA* and Masaaki OKUBO*

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

Abstract:

PCHP is an innovative technology for simultaneous removal of NOx (NO and NO2) and SOx (SO2 and SO3) that is demonstrated for an exhaust gas in glass melting furnaces. NO is oxidized effectively by injecting ozone with the cooling soft water and compressed air using the three-fluid spray nozzle. The oxidized NO2 and SO2 are removed at the existing wet-type desulfurization reactor by absorbing solution.

As a result, de-NOx and de-SOx performance are maintained stable during 140 min experiment. The volume of exhaust gas is 6,735 m3N/h which is cooled 52°C form 150°C by spray and absorbing solution. When injected ozone volume is 1,437 g/h, NOx concentration is reduced to 222 ppm from 301 ppm with removal efficiency of 34% (NO is 38%) in maximum. Furthermore, SO2 concentration decreased to more than 98%. It is suggested that the application of the PCHP to glass melting furnace with wet-type de-SOx equipment is very effective.

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8aB-6

September 8th (Mon.), <10:15-12:00>
Room 2

Ammonia generation using discharge plasma and catalyst
Department of Environmental and Life Sciences,

Kenji YAMASAKI, Takuma NAKAMURA, Hirofumi KURITA, Kazunori TAKASHIMA, and Akira MIZUNO

Toyohashi University of Technology

Abstract:

Ammonia(NH3) generation from nitrogen and water was experimentally studied using a simple plasma-catalyst hybrid reactor. This is intended to be an alternative to urea hydrolysis used in urea-SCR deNOx system for diesel engines.A packed bed type plasma reactor was used to generate intense discharge plasma on the catalyst pellet. Pellets of Al2O3, BaTiO3, TiO2, CeO2, and Ru supported by Al2O3 were examined as catalyst for NH3 generation. Effect of carbon monoxide(CO) addition was examined to improve energy efficiency.Ammonia and nitrogen oxides(NOx) were generated from N2 and H2O by plasma-catalytic reaction while no product was observed without application of discharge plasma. When CO was not supplemented, CeO2 showed the highest ammonia generation but it was smaller than that of NOx generation. With CO addition, Ru resulted in very high NH3 generation and very low NOx generation (nearly zero) compared with other catalysts. Maximum energy efficiency for NH3 generation in this method was 1.1g/kWh.

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September 8th (Mon.), <15:00-15:45>
Room 2

Interaction of nonthermal plasma and Ag-supported zeolite

Hyun-Ha Kim

National Institute of Advanced Industrial Science and Technology

Abstract:

In this work, we report the interaction of nonthermal plasma and Ag-supported zeolite for the effective removal of volatile organic compounds (VOCs). The Si/Al ratio affected the status of Ag, which in turn leaded to a different catalytic performance. The higher the Si/Al ratio, the higher the metallic Ag and the larger the reduction in relative resistivity. The propagation of surface streamer became weak as the Si/Al ratio increased. These electro- and physical properties of zeolites were found to be closely linked with the catalytic activity of Ag/zeolite. The direct interaction of surface plasma with the surface of zeolite was also evidenced by the electron spin resonance (ESR) spectrometer. The possible mechanism on these observation will be discussed.

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September 8th (Mon.), <15:00-15:45>
Room 2

Experiment and Simulation of CO2 Decomposition Using Dielectric Barrier Discharge

○Yota YOSHIDA, Naoki SHIRAI, Satoshi UCHIDA, Fumiyoshi TOCHIKUBO

Tokyo Metropolitan University,

Abstract:

We studied CO2 decomposition using dielectric barrier discharge and packed bed discharge with coaxial electrode configuration at atmospheric pressure aiming the conversion into methanol. To discuss the possibility of conversion of CO2 into methanol, the reaction pathway was investigated by the reaction simulation using CHEMKIN. The simulation results suggest that the rate-limiting reaction is the hydrogenation of CH2O.

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September 8th (Mon.), <15:00-15:45>
Room 2

Effect of Reverse Water-Gas Shift and Methanation Reactions on Plasma-assisted Dry Methane Reforming

○Seigo KAMESHIMA*, Keishiro TAMURA*, Sampson MOORE**, Tomohiro NOZAKI*

*Dept. of Mechanical Sciences and Engineering, Tokyo Institute of Technology,
**Dept. of Mechanical Engineering, University of Minnesota

Abstract:

This study focuses on the reaction mechanism of low temperature plasma-assisted dry methane reforming (DMR). At low temperature (< 500 °C), CO_2 is reduced by H_2 catalytically, which may produce either CO ($CO_2 + H_2 = CO + H_2O$; reverse water-gas shift reaction) or CH_4 ($CO_2 + 4H_2 = CH_4 + 2H_2O$; methanation). We found that the RWGS is dominant reaction pathway, while CH_4 production has negligible effect. Plasma-catalyst hybrid reaction converted CO_2 beyond chemical equilibrium. On the other hand, H_2 conversion was smaller than CO_2 conversion probably because the formation of water is probably the rate-determining step for the RWGS.

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September 8th (Mon.), <16:00-16:45>
Room 2

Study on the Decomposition Performance of the Formaldehyde by Photocatalyst which Processed by the Indirect Dielectric Barrier Discharge

○Tomonari TSURUMI, Masashi TOJO, Shota YAZAWA, Yusuke KUDO, Tetsuro OTSUKA

College of Industrial Technology, Nihon University

Abstract:

A photocatalyst works by only light. It is very clean and can be used semipermanently. Therefore, a photocatalyst is environment-friendly. A photocatalyst has a useful characteristic such as an oxidative decomposition and a super-hydrophilicity. We have been studying about the removal performance of the formaldehyde by photocatalyst substrate which processed by an electric discharge. In this study, indirect electric discharge was used for processing substrates. The evaluation method of substrate was formaldehyde decomposition.

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September 8th (Mon.), <16:00-16:45>
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Study on HCHO Decomposition Performance of Photocatalyst Substrate Produced by Electrostatic Atomization

Shota YAZAWA, Tomonari TSURUMI, Masayuki EGASHIRA, Yusuke KUDO, Tesuro OTSUKA and Junji KOIDO

College of Industrial Techology, Nihon University

Abstract:

A photocatalyst works by only light. It is very clean and can be used semipermanently. Therefore, a photocatalyst is environment-friendly. A photocatalyst has a useful characteristic such as an oxidative decomposition and a super-hydrophilicity. We have been studying about fabrication of photocatalyst substrate which produced by an electrostatic atomization. In this study, photocatalyst substrates were produced by an electrostatic atomization in cone-jet mode. The evaluation method of substrate was formaldehyde decomposition.

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September 8th (Mon.), <16:00-16:45>
Room 2

Fundamental characteristics of sheet stapler using positive and negative corona charging

○Keisuke OZAWA, Toshiyuki SUGIMOTO, Nobuo NOMURA

Yamagata University*, KASUGA DENKI. INC. **

Abstract:

Although there are many sheet products stuck by glue or adhesive material, it is very difficult to stick and peel with keeping strong force by these adhesive materials. In this study, we proposed an electrostatic sheet stapler that can stick and peel the sheet material by an electrostatic force. The sheet material is charged by the positive and negative corona charging using two needle and grid electrodes. It was found that the electrostatic sheet stapler can control sticking and peeingl force by the corona charging and charge elimination and that the sticking force is over than 50gf/cm2.

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September 8th (Mon.), <10:30-11:45>
Room 3

Development of Advanced Water Treatment System Using Discharge-induced Plasmas

○Seiji KANAZAWA*, Yuki ANAN*, Hiroyuki HAYASHI*, Shuichi AKAMINE*, Ryuta ICHIKI*,Taketoshi YAMAMURA**, Yutaka YAMAHIRA**, and Youichi HONZI*

* Faculty of Engineering, Oita University** TRC Co., Ltd.

Abstract:

Advanced oxidation processes (AOPs) are well known for the treatment of waste water. AOPs are facilitated by the use of the combination of UV, ozone, and chemical agents such as hydrogen peroxide. Especially, it is considered that the hydroxyl radicals (・OH) play the important role in the process. In this study, a novel advanced oxidation process using the discharge-induced plasma is proposed. We have developed a system which is combined with filtration, ozonation, and plasmas. The basic property of the discharge-induced plasma is introduced and then the performance of the system is evaluated.

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September 8th (Mon.), <10:30-11:45>
Room 3

Plasma characteristics of discharge in a cell culture medium

○Yusuke Sato*, Takehiko Sato**, Daisuke Yoshino**

*Graduate School of Engineering, Tohoku University, **Institute of Fluid Science

Abstract:

To apply a plasma directly to cells, generation of plasma in a cell culture medium and its characteristics have been investigated. Although there are many studies of plasma in liquids, generation of plasma in a cell culture medium has not been reported. In this study, to reveal plasma-emission species and effect of organic compounds in a culture medium, we investigated the spectrum of plasma emission, OH intensity and H2O2 concentration by comparing with the results of chloride solutions. The spectra analysis showed little difference between the cell culture medium and the chloride solutions. OH intensity and H2O2 concentration had a more relationship with electrical conductivity than chloride species in liquids.

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September 8th (Mon.), <10:30-11:45>
Room 3

The Effect of Oxygen Concentration and Water Vapor Evaporated from Agar on Spore Sterilization Using Plasma

Masayuki KOMATSU

The University of Tokyo

Abstract:

The effects of oxygen concentration and water vapor evaporated from agar medium on plasma sterilization of spore are examined. A nanosecond pulsed streamer discharge is used. The sterilization rate increases with decreased N2 gas flow rate. It indicates that reactive species produced from water vapor evaporated from the agar medium, such as OH and H2O2, sterilizes the spore because the humidity on the agar medium due to the evaporated water from the agar medium increases with the decreased N2 gas flow rate. The spore is also sterilized by O3. The sterilization area by O3 is much wider than that by the reactive species from H2O.

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8aC-4

September 8th (Mon.), <10:30-11:45>
Room 3

Inactivation of microorganisms on the spherical solid surface with DBD

Takuya ARISAKA, Takanori TANINO and ○Takayuki OHSHIMA

Graduated School of Engineering, Gunma University

Abstract:

Inactivation of microorganism on the surfaces, such as a soybean and rice, is important in food engineering.

In this research, we used a biodegradable plastic sphere, which has 6 mm in diameter, as a food solid model. The plastic spheres of 25 g were immersed in Aspergillus niger or Bacillus subtilis spore suspension, and dried at room temperature overnight. The cell concentration of A. niger and B. subtilis spore suspension were 1.0×108 CFU/mL and 1.0×106 CFU/mL, respectively. The electric discharge unit consisted of the silica glass board and the aluminum two tapes, and AC high voltage (6.2 kVp and

30kHz) was applied to the aluminum tape. DBD (Dielectric Barrier

Discharge) was generated between the aluminum tapes. The electric discharge unit was put on a rotary shaker (75 rpm), and survival ratios were measured before and after DBD treatment. In the case of A. niger, the survival ratio after DBD treatment of 30 min was 10-5. This system was useful for the inactivation of mold on the solid surface. However, it was hard to inactivate B. subtilis spore with our system. It is thought that expansion of discharging space and protraction of contact time are required in order to inactivate B. subtilis spores.

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8pD-1

September 8th (Mon.), <15:00-16:30>
Room 3

Development of low-particle-emission corona discharge ionizer by electrode heating. Part.3 ,

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

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

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℃, the amount of deposition of particle on the electrode decreased in comparison with a case of the non-heating. In addition, as a practical heating method of ionizer electrode, we devised a self-heating-type electrode using the Joule heating of the resistor. As a result of this experiment, we found that it was possible to heat the electrode to the desired temperature. In this paper, we report the results of investigation on heating characteristics of self-heating-type electrode.

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8pD-2

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Generation process of induction surge from the charged body.

○Kenta WATANABE and Hirofumi SHIMOKAWA

Abstract:

In this study, we used the van-der-Graaf generator type that can easily generate high voltage. A copper wire is being put from the generator at some distance. Other end of the wire is being put near metal plate grounded. The spark discharge was generated between wire and metal plate, when the generator operated. The purpose of this study is to clarify the surge phenomenon that occurs when an object having a high charge potential

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Room 3

Influence of nitrogen concentration of atmosphere on ignitability of powders

Kwangseok CHOI*, Koujirou NISHIMURA**

*JNIOSH、**TIIS

Abstract:

As useful method to prevent dust explosions, inerting using nitrogen (N2), which is an incombustible gas, has been used in industries. This paper is a report of the relationship between the minimum ignition energy (MIE) of powders due to an electrostatic sparks and the minimum oxygen concentration (MOC) for combustion. In this paper, we have changed the N2 amount in the air in order to control the oxygen concentration. The Hartman vertical-tube apparatus was used in this study. The control range of the dust concentrations of the MIE apparatus used in this study is from 0.5 kg/m3 to 1.8 kg/m3. The maximum spark energy achieved in this study was 1000 mJ. Six sample powders were used in the experiment. As a result, the inerting of N2 has an effect on the ignitability of sample powders as expected. The MIE of all powders used in this study increased due to the increase in the amount of N2 in the air. We finally suggest that 84 % (or above) of N2 for inerting affects the prevention of dust explosions of polymer powders due to electrostatic sparks.

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Room 3

Development of Electrostatic Ground Monitoring Device

○Tomofumi Mogami, Fumiaki Hashimoto, Tomoju Hirota, Teruo Suzuki, Fumio Yamada, Nobuo Nomura

Kasuga Denki INC

Abstract:

Of the industrial accidents of fires and/or explosions due to electrostatic discharges, spark discharges are most frequent ignition source. To solve and prevent spark discharges, all the groundings of the conductors need to be checked. We have developed an electrostatic ground monitoring device. The electrostatic ground monitoring device mainly has two ground wire connections, pin A which is connected to the ground and pin B which is connected to the LED. The electrostatic ground monitoring device can be detected in less than the resistance value (below 100 kΩ) defined in static safety guidelines. This electrostatic ground monitoring device is expected to be very useful and reliable in preventing problems originating from spark discharges.

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Breakdown Characteristics across Micrometer-scale Surface Gaps under Negative Impulse Voltage

Hiroyuki IWABUCH

Department of Electrical Engineering and Information Systems

Abstract:

With the miniaturization of MEMS devices, the insulation width and the separation between electrodes in such devices have been accordingly reduced. Consequently, electrical breakdown phenomenon across micrometer-scale gap is of great practical interest for insulation designing of miniaturized devices. This paper reports breakdown phenomenon under negative impulse voltage application across micrometer-scale surface gaps fabricated on SO wafers. When applying the negative impulse voltage, the breakdown voltage was constant and independent of gap width and electrode material. The result indicates that the breakdown voltage was strongly affected by the electric intensity on the cathode: the F-N current by the electric field on the cathode can induce the breakdown.

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9aB-1

September 9th (Tue.), <10:00-10:45>
Room1

Development of Low-Temperature Sintering Technique for Plastic Dye-Sensitized Solar Cells

Shungo Zen

The University of Tokyo Department of Advanced Energy

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 by half. 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 propose two techniques for TiO2 photoelectrode, there can reduce the sintering temperature from 450 C to 150 C. We were succeded in manufacturing plastic DSSC at 150-C sintered by using new techniques.

The conversion efficiency of plastic DSSC was 3.1 %.

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9aB-2

September 9th (Tue.), <10:00-10:45>
Room 1

Production of Platinum Particles on the Surface of Porous Substrates Using A Few Tens keV Electron Beam Induced Reduction Method

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

* Japan Atomic Energy Agency ** Saitama Institute of Technology

Abstract:

The production of noble metal catalyst particles on the surface of catalyst substrates were studied using low energy electron beams (EBs) as a radiation-induced reduction method. Porous alumina substrates were impregnated in a solution containing PtCl42- ions and ethanol. The surface of the substrates was irradiated with EBs. As a result, platinum particles were produced on the surface of the substrates. The platinum particles had catalytic activity. The obtained results suggest that low energy EBs can be applied to the production of noble metal catalysts as new application of a radiation-induced reduction method.

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9aB-3

September 9th (Tue.), <10:00-10:45>
Room 1

Stabilization method of gold nano-particle on porous materials using an electrospray microreactor in liquid

Yoshiyuki TERAMOTO

AIST

Abstract:

Gold nano-particls were stabilized on porous materials using a novel method. First, colloidal gold solution was prepared using an electrospray microreactor in liquid. Its particle size was around 3 nm regardless of atomizing time of electrospray. And then, carriers were immersed in the prepared colloidal gold solution. The forms of supported gold nanoparticles were identified as hemispheres ca.3-5 nm in diameter. Their sizes increased with increasing the colloid concentration (= atomizing time of electrospray). On the other hand, its size was hardly affected by the carrier material.

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9aA-1

September 9th (Tue.), <11:00-12:00>
Room 1

Emission Spectroscopic Measurements of Atmospheric-pressure Non-thermal Plasma Jets Generated Using Glass- and Alumina- Tubes

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

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***

Abstract:

Atmospheric-pressure non-thermal plasma jets (APPJs) have been widely studied for the processing of a variety of materials and biomedical applications. In the past, a number of papers related to the APPJs' emission spectra have been already reported. However, the emission spectra of the APPJs generated using different dielectric tubes have not been adequately investigated and reported yet. In this study, therefore, the emission spectra of the APPJs generated using glass- and alumina- tubes were measured to compare how the amount and types of active species changes. In this experiment, an observation system using an ICCD camera coupled to a spectrograph was used to measure the emission spectra. The experimental results show えｄ the amount of active species such as OH＊ (309 nm), N2＊ (C3Πu

- B3Πg, 337.1 nm), and N2+＊ (B2Σu+ - X2Σg+, 395.1 nm) were increased by using alumina tube compared to glass tube. In addition, the experimental results suggest that there are some different production mechanisms of active species between using glass- and alumina- tubes.

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9aA-2

September 9th (Tue.), <11:00-12:00>
Room 1

Effect of interval time between pulses on streamer discharge

○Yuta Ishibashi**,Yoshiyuki Teramoto*, Ryo Ono**

School of Engineering, The University of Tokyo National Institute of Advanced Industrial Science and Technology (AIST)* Graduate School of Frontier Sciences, The University of Tokyo**

Abstract:

Effect of interval time between pulses on discharge was investigated using a double-pulse corona discharge in N2. N2(C) production and discharge energy of 2nd pulse discharge decreased with decreasing interval time (Δt), regardless of same applied voltage. Additionally, breakdown voltage of 2nd pulse significantly decreased with decreasing Δt. When Δt was 20 □s, breakdown voltage of 2nd pulse came down from 6.3 kV to 2.6 kV.

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9aA-3

September 9th (Tue.), <11:00-12:00>
Room 1

Measurement of negative streamer propagation

Hanakawa Wataru

The university of Tokyo

Abstract:

A negative pulsed corona discharge streamer is observed in a point-to-plane gap using a short-gated intensified CCD camera and a streak-like photograph. When the applied voltage is low, the streamer propagates as far as the middle of the gap. It is different characteristics from the positive streamer. The shape of the streamer head is rounded and thicker than that of the positive streamer. The streak-like photograph shows that the negative streamer propagates in three stages: (i) primary streamer, (ii) strong return stroke from the positive plane to the negative point electrode, and (iii) secondary streamer.

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9aA-4

September 9th (Tue.), <11:00-12:00>
Room 1

Numerical analysis of negative and positive streamer corona discharge propagations

Daiki Saito

Department of Advanced Energy, The University of Tokyo

Abstract:

We numerically calculate the two-dimensional point-to-plane negative and positive streamers in a dry-air environment. The calculation has been performed in the case of a point to plane corona discharge filled with dry air (80% N2, 20% O2) at atmospheric-pressure ambient temperature. The calculation shows difference between negative and positive streamer propagations.

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9pC-1

September 9th (Tue.), <14:00-15:00>
Room 1

2-D Concentration Distribution of ROS Supplied on Liquid Target by Non-thermal Plasma Jet

○Masaki HAMADA, Yasutaka WAKABAYASI, Wataru ETO, Yasuhumi ABE, Keisuke KIHARA, Miho SAKAI, and Toshiyuki KAWASAKI

Faculty of Engineering, Nippon Bunri University

Abstract:

The distribution of reactive oxygen species (ROS) generated by a plasma jet has been investigated using the chemical reagent prepared in our laboratory. This chemical reagent provides the important and special information which can't be obtained by other methods. In this paper, the influence of the irradiation distance, supplied gas and water on the 2-D ROS distribution was studied using the chemical reagent. Helium (He) gas with or without oxygen (O2) were supplied into the generator. The irradiation distance was changed from 5 mm to 50 mm. The experiment with the water layer on the reagent was also conducted in order to study the production and transport of ROS through water. The relative concentration distribution was also obtained by an absorbance measurement. The ROS distribution significantly depended on the irradiation distance in He plasma jet. The high efficiency and local supply of ROS to the target can be controlled by the irradiation distance. In the case of O2 (0.5%)/He mixture gas supply, it is considered that the ROS distribution significantly influenced by the synergistic effect of long-lived species generated in the plasma phase. The interesting 2-D distribution patterns were visually obtained in the water using the reagent underwater.

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Room 1

Influence on Plants by Irradiation of Atmospheric-pressure LF Plasma Jet

○Kei ETO, Daichi OTORI, Shuichi AKAMINE, Ryuta ICHIKI, Seiji KANAZAWA

Department of Electrical and Electronic Engineering, Oita University

Abstract:

In this study, Arabidopsis thaliana was irradiated by atmospheric-pressure low frequency (LF) plasma jet. Here, helium gas was used as an operating gas. We evaluated the influence of the atmospheric-pressure plasma jet on growth of the plants by measuring the leaf area of Arabidopsis thaliana and comparing with a control group. We also measured chlorophyll fluorescence of leaves. As a result, the effect of atmospheric-pressure plasma jet was different with state and form of plants. The growth stimulation was observed for the seeds irradiated by atmospheric pressure-plasma jet after vernalization. After germination the apoptosis occurred for the leaves irradiated by the plasma jet. This inactivation was related to the intensity decrease of chlorophyll fluorescence from the leaves.

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9pC-3

September 9th (Tue.), <14:00-15:00>
Room 1

Analysis of Biomolecular Damage and Cellular Responses Induced by Atmospheric Pressure Plasma Exposure

○Hirofumi KURITA*, Kaori SANO*, Mika SHIMIZU*, Tomoko NAKAJIMA*, Kazue MIZUNO**, Ryo ONO**, Hachiro YASUDA*, Kazunori TAKASHIMA*, and Akira MIZUNO*

*Toyohashi University of Technology, **The University of Tokyo

Abstract:

Recently, non-thermal atmospheric pressure plasma has been studied in biological and medical applications. Among them, reactive oxygen and nitrogen species (RONS) in aqueous solution injected by the plasma exposure play an important role. Therefore, we have been trying to use large DNA molecules as a biomarker to estimate intensity of RONS in the aqueous media. Here, we report the measurement of OH radical by electron spin resonance (ESR) spectroscopy with spin trapping technique. The correlation between the signal intensity of OH radical measured by ESR and the number of strand breaks obtained by single-molecule DNA observation was examined. Furthermore, cellular responses after plasma exposure in human cell lines were also studied.

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Room 1

DNA Detection using Dynamic Change of Microbeads Dielectrophoresis with DNA Labeling

○Michihiko Nakano, Zhehnao Ding, Hiromichi Kasahara, Junya Suehiro

Kyushu University

Abstract:

In this paper, a new DNA detection method using dielectrophoresis of dielectric microbeads is described. This method can detect DNA amplified by polymerase chain reaction (PCR) rapidly and easily. PCR is used to diagnose bacterial/viral infection as the one of the most sensitive and specific methods. PCR amplifies DNA for the target pathogens. After PCR, the amplified DNA should be determined by a method such as an agarose gel electrophoresis. This takes a few hours and requires complicated processes. It was found that dielectrophoresis of the microbeads was dramatically altered by DNA immobilization on them. The DNA-labeled microbeads were trapped on a microelectrode by positive dielectrophoresis, whereas the pristine ones were repelled from the microelectrode. The trapped microbeads were measured by electrically. This method is faster than a standard DNA detection.

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September 9th (Tue.), <10:00-12:00>
Room 2

Active Fluid Control by Multi-electrode Microplasma Actuator

○Yoshinori Mizuno*、Marius Blajan**, Hitoki Yoneda***, Kazuo Shimizu*,**

*Graduate School of Engineering, Shizuoka University, **Organization for Innovation and Social Collaboration, Shizuoka University, ***Institute for Laser Science, The University of Electro-Communications

Abstract:

In this study, multi-electrode microplasma actuator for active fluid control was investigated. Our microplasma electrode could generate plasma by relatively low voltage less than 1.5 kV due to the μm discharge gap. Such low voltage is easily controlled by semiconductor switches and small step-up transformer. This contributes miniaturize the system on parallel operation the electrodes system. Therefore, more active flow control could be carried out compared as traditionally plasma actuator. Air flow induced by the atmospheric microplasma was measured by the Particle Image Velocimetry (PIV). Incense smoke sub-micron diameter was used for tracer particles and Nd YVO4 532 nm laser was utilized to visualize the tracer particles. By applying sinusoidal voltage 1.3 kV, 15 kHz, to the multi-electrode microplasma electrodes, air flow velocity of 0.1~0.6 m/s was obtained and its direction (left, right, up, down) was controlled without changing the electrode geometry.

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September 9th (Tue.), <10:00-12:00>
Room 2

Selective Production of Radicals Using Vacuum Ultraviolet Light

Yusuke Tokumitsu

The University of Tokyo

Abstract:

According to the recent studies of plasma medicine, it is expected that radicals have the therapeutic and sterilization effects. But the reaction mechanism of the plasma is so complicated that it is difficult to clarify which radicals are really effective. Therefore, we developed a new device which uses a vacuum ultraviolet light to selectively produce radicals, and measured the densities of ozone and OH produced by the device and compared with simulation results. It was revealed that the device can produce sufficient quantity of radicals.

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9aC-3

September 9th (Tue.), <10:00-12:00>
Room 2

Effect of gas flow rate on treatment of mouse melanoma cells using a nanosecond streamer discharge

Taketoshi AKIYAMA

The University of Tokyo

Abstract:

Recently it is expected that atmospheric pressure plasma is useful to induce apoptosis, and plasma is used for cancer treatment. We treated mouse melanoma cells (B16F10) using a nanosecond streamer discharge, and examine the effect of gas flow rate on the cell survival rate. The effect of water vapor evaporated from the culture medium that produce radicals such as OH and H2O2 is discussed.

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September 9th (Tue.), <10:00-12:00>
Room 2

Effect of humidification for the sterilization of Staphylococcus aureus on the electrode surface by corona discharge.

○Takahiro Miura、Akinori Zukeran、Jun Sawai

Kanagawa Institute of Technology

Abstract:

In this paper, it is investigated to sterilize staphylococcus aureus on an electrode in an electrostatic precipitator (ESP) under high relative humidity condition. The ESP consisted of a precharger and a collecting unit. The bactrum was put on the grounded plate electrode surface of the precharger and the collecting unit, whereby that was sterilized by corona discharge. The relative humidity was controlled using pure water or tap water. As a result, Staphylococcus aureus was sterilized at relative humidity greater than 75%. However, the bacterium on the upstream side of the electrode in the precharger was not sterilized. The effect of humidification by pure water was almost same as that by tap water.

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9aC-5

September 9th (Tue.), <10:00-12:00>
Room 2

biofilm sterilization by mist air discharge

○Ryota SUGANUMA*, Koichi YASUOKA*

*Faculty of Engineering, Tokyo Institute of Technology

Abstract:

Biofilm that is any group of microorganisms sticks to the wall and floor of food factory, pharmaceutical factory and causes environmental degradation. Hydrogen peroxide solution, ozone water and advanced oxidation process (AOP) were tested to examine their availability for killing the biofilms of Pseudomonas aeruginosa. AOP showed higher bactericidal activity than other methods. Though the hydrogen peroxide can be generated with a dielectric barrier discharge in mist air, the concentration was found to be too low to remove the biofilm.

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Room 2

Inactivation of Airborne Microorganism by Corona Discharge Plasma

Takanori TANINO, Ataru MIYAZAKI, Takuya FURUHASHI* and ○Takayuki OHSHIMA

Graduated School of Engineering, Gunma University、*Mitsubishi Electric Corporation

Abstract:

Inactivation of airborne microorganism by corona discharge was investigated using Staphylococcus epidermidis as the model airborne microorganism. Significant decrease of airborne S.epidermidis number compared to that of natural attenuation without corona discharge plasma was detected. The living cell number of S.epidermidis trapped on grand electrode plate was almost tithe of decreased airborne S. epidermidis, and this successfully demonstrated inactivation of airborne microorganism by corona discharge plasma.Several applied voltage waveforms, DC positive, DC negative, DC superimposed pulse and rectangular wave, were used to generate corona discharge plasma. In all applied voltage waveforms, airborne S.epidermidis was inactivated. But the inactivation was depended on consumed energy and there was no difference between applied voltage waveforms. Damages to microorganisms' cell-surface and genomic DNA by the exposure of corona discharge were also investigated. Damage to cell-surface was investigated using fluorescently labeled yeast.Decrease of fluorescence localized yeast cell-surface that suggests damage to cell-surface was observed. Damage to genomic DNA was investigated by polymerase chain reaction using S. epidermidis genomic DNA as the template. The resulted weak band strength of PCR products using corona discharge plasma exposed S. epidermidis suggested damage of genomic DNA by corona discharge.

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September 9th (Tue.), <10:00-12:00>
Room 2

Electrification of Slide Glass and fixing of fluorescent beads on it by AC Corona Discharge

○Tomoko NAKAJIMA*, Jumpei HIGASHIO**, Hachiro YASUDA*, Hirofumi KURITA*, Kazunori TAKASHIMA* and Akira MIZUNO*

*Department of Environmentl and Life Science, TUT, **TREK JAPAN Co.Ltd.

Abstract:

With a view to fixing and handling of DNA and viruses for fluorescent microscopic observation, electrification of microscopic slide glass by AC corona was studied. In result, negative surface potential appeared on slide glass by AC corona exposure. The surface potential inversely related distance between electrode and slide glass; though it appeared at the relatively long distance without apparent AC corona, and nearly disappeared at distance shorter than most suitable one. Negatively charged fluorescent beads showed coagulation on the bottom side of AC corona treated slide glass which has positive electric potential.

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September 9th (Tue.), <10:00-12:00>
Room 3

Effect of the electronegative gas on neutralization characteristics of a corona-discharge-type ionizer

,Yudi KRISTANTO,Wanting HE*,Takeshi MATSUO*,Naoyuki SATO*,Kazuo OKANO**,Takashi IKEHATA*

*Institute of Applied Beam Science, Ibaraki University **Department of Electrical Engineering, The Polytechnic University

Abstract:

We investigated the neutralization characteristics of a corona-discharge -type ionizer in different atmospheric gases; ambient air, pure nitrogen, mixed N2-O2 and N2-SF6 gases with changing the partial pressure of O2 and SF6, respectively. The product final voltage VPF in pure nitrogen shows a deviation to about -2 kV. However, by introducing SF6, VPF reduced to the one equivalent to air. The amount of SF6 gas needed to improve the ion balance is many orders of magnitude smaller than that of O2 gas.

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9aD-2

September 9th (Tue.), <10:00-12:00>
Room 3

Development of the Corona Discharge Air Ionizer Applied Electrical Field of Charged Surface

○Takashi Sato*,Takashi Ikehata*, Kazuo Okano**

*Institute of Applied Beam Science, Ibaraki University **Department of Electrical Engineering, The Polytechnic University

Abstract:

This paper proposed a new type of corona discharge air ionizer, applied electrical field of charged surface to neutralize the object. To achieve that, the corona discharge air ionizer is operated extremely close to the charged surface. There's a problem that it may turn the corona discharge air ionizer into an electrostatic charger. To avoid becoming an electrostatic charger, emitter voltage operated at lower than conventional the corona discharge air ionizer, which generates few ions. We experimented characteristics of neutralizing the charged surface changing factors [Waveform, Voltage, Frequency, Height], reported comfortable value based on these result

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The electrode materials and preventing the erosion of them on corona-discharge electrodes of the ionizer for clean rooms part2

○Masanori SUZUKI*, Tomokatsu SATO*, **

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

Abstract:

In recent years, static electricity has become a major cause of production yield loss in LSI or LCD production processes. However it was serious problem that corona-discharge electrodes of the ionizer for eliminating static electricity in clean rooms emit fine particles through the erosion caused by ion sputtering. In our previous paper, we described the cleanroom use ionizer prevented the particle generation from its electrodes and we also reported the result we evaluated our developed electrode prevented the erosion caused by ion sputtering. In this paper, we will report the result we evaluated new erosion-proof electrodes we developed through the long endurance test and the measurement of metal contamination on the surface of silicon wafers.

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Room 3

Bipolar-Type Electrostatic Ionizer used in Pneumatic Powder Transport Facility

Kwangseok CHOI*、Teruo SUZUKI**、Tomofumi MOGAMI**、
MizukiYAMAGUMA*

*JNIOSH、**Kasuga Denki INC

Abstract:

As a method to prevent or mitigate explosion due to electrostatic discharges during the loading of polymer granules in a metal silo, we have developed a novel bipolar-type electrostatic ionizer. In this study, we investigated experimentally the practical version of the bipolar electrostatic ionizer with a pneumatic powder transport facility. As a sample, 300 kg of polypropylene (PP) granules 3 mm in size was employed in this study. The specific charge of PP was clearly decreased by approximately 85 percent with the novel bipolar electrostatic ionizer. The brush discharges, as well as the incendiary bulk surface discharges, completely died out inside the silo when using the novel bipolar electrostatic ionizer.

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Room 3

Cause of a Fire that occurred in Polymerization Tank

Hiroyuki TAMURA、Toshiyuki WATARAI

National Research Institute of Fire and Disaster

Abstract:

A fire occurred when a worker cleaned the inside of a polymerization tank, and the worker was injured. Because the toluene was used in the tank, it was thought that the evaporating toluene had been ignited. The electrostatic discharge in the tank was doubted as a fire cause. We examined the electrostatic charge, the electrostatic discharge, and the discharge energy. As a result, strong electrostatic charge happened by following.- Drawing out a rag made of cotton for wiping machines from a bag- Washing the rags by rubbing in the toluene The discharge energy exceeded the minimum ignition energy of the toluene though it was the electrostatic discharge between ungrounded conductors such as a metal pail and a human body. It is necessary to take the grounding of conductors surely on the site in the flammable atmosphere to prevent the electrification and the electrostatic discharge.

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September 9th (Tue.), <10:00-12:00>
Room 3

Analysis current waveforms induced by charged walking human bodies

○Nakao Kazuki, Nishimura Ryo

*Graduate School of Engineering, Tottori University

Abstract:

We aim to construct a non-contact detection system of human walking motion for personal identification by using variation of charges in walking human bodies. This system measures very small charge fluctuations caused by walking as induction currents flowing to a grounded electrode. Fourier analyses were carried out for the obtained induced current waveforms. Comparing the results of the Fourier analyses, features of individuals can be detected. We also found that a number of steps a minute gives significant effects on the results of the Fourier analyses for experiments under the condition of fixed walking pace, walking velocity and distance between the detection electrode and walking human and that the difference of apparel gives little difference in the waveforms of Fourier analyses of induced currents under the same environmental conditions.

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September 9th (Tue.), <10:00-12:00>
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Detection Technique of Electrostatic Induction Current Generated by Change of Electric Potential of Human Body in Walking Motion

Koichi Kurita

Kinki University

Abstract:

I here present a method for measuring human physical activity, which is based on detecting the electrostatic induction current generated by the walking motion under non-contact and non-attached conditions. A theoretical model for the electrostatic induction current generated because of a change in the electric potential of the human body is also proposed. The electric potential of the subject is determined by integrating the electrostatic induced current. The values of the estimated electric potential are qualitatively in good agreement with those obtained in conventional experiments by using the ordinary contact-type hand electrode. By comparing the obtained electrostatic induction current with the theoretical model, it becomes obvious that this model effectively explains the behavior of the waveform of the electrostatic induction current. The normal walking motions of daily living are recorded using a portable sensor measurement located in an ordinary house. The obtained results show that detailed information regarding physical activity such as a walking cycle can be estimated using our proposed technique. This suggests that the proposed technique, which is based on the detection of the walking signal, can be successfully applied to the estimation of human physical activity.

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9pD-1

September 9th (Tue.), <14:00-15:00>
Room 3

Experimental study on influence of air applied to electrostatic field sensor on electrostatic field measurement

○Naoto NOGERA*, Teruo SUZUKI*, Kwangseok CHOI** and Mizuki YAMAGUMA **

○*Kasuga Denki Co., Ltd., **National Institute of Occupational Safety and Health, Japan

Abstract:

Electrostatic charges and/or discharges on powders bring about ignition and explosion of powders. Electrostatic problems on the powder must be taken care of in the industry. We have developed an electrostatic field sensor which measures electrostatic hazards. The electrostatic field sensor was supplied with compressed air in order to protect powder particles from getting into the sensor. This paper is related to how the compressed air affects the performance of the electrostatic field sensor. As a result, the performance of the electrostatic field sensor was affected by the compressed air. Namely, the experimental values and theoretical values was not the same. That is because movement of the coppers inside the electrostatic field sensor was disturbed by the compressed air.

2014 Annual Meeting of The Institute of Electrostatics Japan
Hiroshima International University
September 7-8, 2014

9pD-2

September 9th (Tue.), <14:00-15:00>
Room 3

A study on performance of electrostatic filed sensor attached to loading pipe of pneumatic powder transport facility

○Naoto NOGERA*, Teruo SUZUKI*, Kwangseok CHOI** and Mizuki YAMAGUMA **

○*Kasuga Denki Co., Ltd., **National Institute of Occupational Safety and Health, Japan

Abstract:

have developed an electrostatic field sensor which measures electrostatic hazards generated from charged powders. This paper is a report on the performance of the electrostatic field sensor using pneumatic powder transport facility and 300 kg of polypropylene powder. An electrostatic field sensor was attached to the end of the loading pipe inside the silo. As the result, the electrostatic field meter generally performed, as expected. The measured values obtained from the electrostatic field meter were similar to those which were transferred from charge-to-mass ratio, obtained from the Faraday cage method. However, some data was affected by modification method of the electrostatic field sensor before use. Several interesting data were also obtained and discussed.

2014 Annual Meeting of The Institute of Electrostatics Japan
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9pD-3

September 9th (Tue.), <14:00-15:00>
Room 3

Charge neutralisation from the side surface of an insulating plate

A. Ohsawa

National Institute of Occupational Safety and Health

Abstract:

This work is a response to a comment, "Is the charge neutralisation from the side surface of a thin insulating object available?", given at the 14th International Conference of Electrostatics in Budapest, 17--19 April 2013. We investigate the phenomena of this charge neutralisation using 2-D electrohydrodynamic simulations. Results of a preliminary simulation with an insulating plate of which both the upper and lower surfaces are initially charged at 1 μC/m^2 are presented in this report

2014 Annual Meeting of The Institute of Electrostatics Japan
Hiroshima International University
September 7-8, 2014

9pD-4

September 9th (Tue.), <14:00-15:00>
Room 3

Basics properties of grid type charge control device

Takahisa KIMURA

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Abstract:

To evaluate the state of paint curing quantitatively, we proposed new paint curing sensor with a grid type charge control device. The device can charge up the painted material to measure the charging up velocity depending on the state of paint curing. After the measurements the static charge of the material should be eliminated immediately. In this study, we propose charging up and chare elimination model of the proposed devise. The basic characteristic of this device was also investigated experimentally. It was found that tendency of the experimental results agree with the theory devised from the model.