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

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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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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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**

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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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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*

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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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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.