(1)

NO Removal Using Dielectric Barrier Discharges in a Multi-rod Reactor Stressed by AC and Pulsed High Voltages

Hassan Wedaa, Mazen Abdel-Salam, Adel Ahmed and Akira Mizuno

Abstract:

This paper is aimed at investigating the nitric oxide (NO) removal using dielectric barrier discharges (DBD) in a multi-rod reactor stressed by ac and pulse high voltages. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, use of the -alumina pellets and the voltage type) on the discharge power and NO removal rate have been studied experimentally in the multi-rod DBD reactor. When the reactor was filled with -alumina pellets, improvement in NO removal rate was observed. The pulse voltage gives higher NO removal rate in comparison with ac voltage at the same energy density. Records of the discharge photograph and the emission intensity have been made at varying voltage amplitude, frequency, and gas flow rate. The records confirm the dependency of the discharge power on these parameters.

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(2)

-Novel techniques for optimal design and analysis of corona suppression systems

H. El-Kishky, M. Abdel-Salam, H. Wedaa and Y. Sayed,

Abstract:

The use of stress-grading systems proved to be essential to suppress corona in the end-turn zone of high voltage machines. Moreover, power dissipation in the end-turn region is believed to be a major factor in the deterioration process of surface field grading systems. This paper introduces two novel techniques for the design and analysis of both linear and nonlinear corona-suppression systems of high voltage machines. The first technique is based on the design of linear stress-grading systems through power-loss minimization and equalization of electric field along the end-turn zone. The second technique is based on the simulation, modeling and analysis of nonlinear stress-grading systems in the time domain using the describing function method. This model generates the time variation of the resistances as well as the surface electric field and potential and ultimately converges to the optimal design parameters of the stress-grading system.

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(3)

Design of Stress-Grading Systems Based On Power Loss Minimization

H. El-Kishky, M. Abdel-Salam, H. Wedaa and Y. Sayed,

Abstract:

It is essential to use stress-grading systems to suppress corona in the end-turn zone of high voltage machines, which ensure uniform electric field distribution along the end-turn region. Since power dissipation is a major factor in the deterioration process of the grading systems, it is necessary to account for the power loss in the design these systems. This paper presents a novel technique for the design of a linear resistive stress-grading system for high voltage stator winding. This technique is based on minimization of the power loss through the stress-grading system along with equalization of potential along the end-turn zone. A one-dimension lumped circuit model was used and a non-linear constrained optimization algorithm is programmed using MATLAB®. Different discretizations of the grading system are investigated. The lumped circuit model was realized in an experimental setup that confirmed the results of the proposed technique.

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(4)

-NOx Removal Using Dielectric Barrier Discharges in a Wire cylinder Reactor Stressed by High Pulse Voltage

Hassan Wedaa, Mazen Abdel-Salam, Adel Ahmed and Akira Mizuno

Abstract:

This paper is aimed at investigating the nitrogen oxides (NOx=NO+NO2) removal using dielectric barrier discharges (DBD) in a wire-cylinder reactor filled with dielectric pellets and stressed by high pulse voltage. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, and use of the dielectric pellets) on the discharge power and NO/ NOx removal efficiency have been studied experimentally. Two dielectric materials (-alumina and glass pellets) were evaluated for their ability to reduce NOx using non-thermal plasma. To improve the NOx removal efficiency, the output of the plasma reactor was pumped into sodium sulfite (Na2 SO3) solution with different concentrations to absorb NO2. It has been found that the discharge power and NO/ NOx removal efficiency increase with the increase of the applied peak voltage and frequency. On the other hand, the discharge power is independent of the gas flow rate, while the NO/ NOx removal efficiency increases with decreasing gas flow rate. The -alumina pellets give the best performance for removing both NO and NOx when compared with others due to their ability to oxide NO to NO2 and absorb the resulting NO2. The NOx removal efficiency increases with the increase of the concentration of sodium sulfite solution.

Keywords:

-alumina pellets , Dielectric barrier discharges , NO removal , ac high voltage , multi-rod DBD reactor , pulse voltage

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ICESP (International Conference of Electrostatic Precipitation) , , 9-13 pp.

(5)

Characteristics of Sliding Discharge in a Multi-Rod Reactor

H. Wedaa, M. Abdel-Salam, A. Ahmed, and A. Mizuno

Abstract:

This paper is aimed at investigating the characteristics of a sliding discharge (SD) including the onset voltage (VO), spark voltage (VS), and current-voltage (I-V) relationship in a multi-rod reactor stressed by sinusoidal AC or pulse voltage. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, and voltage type) on the characteristics of the reactor sliding discharge (VO, VS and I-V relationship) have been studied experimentally. It has been found that the DC onset and spark voltages increase with the increase of the gas flow rate, while the effect of the frequency on them is not pronounced. The onset and spark voltages of the stressed reactor for sinusoidal AC voltage are lower than those obtained under a pulse voltage of the same peak value. Subsequently, the sliding current increases with the increase of the sinusoidal AC high voltage, the frequency, and the negative DC voltage, while, it decreases with the increase of the flow rate. It is observed that stressing the reactor with sinusoidal AC voltage gives higher values of sliding current than those obtained using a pulse at the same peak voltage. Stressing the reactor with sinusoidal AC voltage gives higher values of the NO removal efficiency than those obtained using pulse voltage.

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J. Phys. Conf. Series 301, Intern Conf. on Electrostatics, Bangor, Wales, UK , ,

(6)

Time-Domain Analysis Of Nonlinear Stress-Grading Systems For High Voltage Rotating Machines

H. El-Kishky, M. Abdel-Salam, H. Wedaa and Y. Sayed

Abstract:

This paper introduces a new approach for the design and analysis of nonlinear stress-grading systems for high voltage rotating machines. The method is based on the simulation and modeling of stress-grading systems using a nonlinear lumped circuit model. The nonlinear model is analyzed in the time domain using the describing function method. The model generates the time variation of the resistances as well as the surface electric field and potential and ultimately converges to the optimal design parameters of the stress-grading system. The model is iterative and adaptive where a deviation from the nominal uniform field and the upper and lower bounds on the resistance values as well as bounds on the nonlinearity factor can be set to generate optimal design parameters of the stress-grading system.

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Electrical Insulation and Dielectric Phenomena, 2003 Annual Report Conference on , , 482-485

(7)

A CUI Module for the Analysis of Stress-Grading Systems of High Voltage Rotating Machines

EI-Kishky, M. Abdel-Salam, and others

Abstract:

Stress-grading systems are essential for the suppression of corona in the end-turn zone of high voltage rotating machines. Unfortunately, design of stress-grading systems in industry is almost entirely based on experimental trial-and error techniques. This paper introduces a novel graphical user interface (GUI) model for the selection and design of stress-grading systems of high voltage rotating machines. The GUI model is based on two major design approaches for stress-grading systems: i: minimization of power-loss and, ii: time-domain analysis of nonlinear stress-grading systems using the describing function method. Comprehensive codes written in both FORTRAN and MATLAB® were developed for the purpose of design and analysis of linear and nonlinear stress-grading systems of high voltage rotating machines. A GUI was developed to enable the design engineer to select analyze and optimize stress-grading systems. This graphical front-end to FORTRAN and MATLAB® codes utilizes built-in functionality of MATLAB® to create graphical interface objects, interface with compiled FORTRAN functions, and generate design and analysis reports based on the data gathered from the source codes.

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Proceedings of the IEEE Conference on Elcctdcallnslllation and Diclcctdc Phenomena (CEIDP), flhuqllerque, NM , ,

(8)

Two-dimensional modelling of dielectric barrier discharges using charge simulation technique-theory against experiment

Hassan Wedaa Mazen Abdel-salam Adel Ahmed Akira Mizuno

Abstract:

This study is aimed at calculating the discharge onset voltages and power loss of the AC discharge using the charge simulation technique in a wire-cylinder reactor with a dielectric barrier at atmospheric pressure and room temperature. The calculation of the discharge onset voltages is based on the criterion of self-sustained growth of onset streamers and Trichel pulses in positive and negative half cycles, respectively. The emission of ions (space charges) from the wire surface is assumed to take place when the magnitude of the surface charge exceeds the corresponding onset values based on pre-defined discharge onset voltages for both positive and negative half cycles. The space charges are displaced by the prevailing electric field until accumulated on the glass surface. Discharge power loss corresponds to the energy required for the displacements of emitted space charges. The calculated values of the discharge onset voltage and power loss agreed reasonably with those measured experimentally.

Keywords:

onset voltage, space charges, dielectric barrier discharges, charge simulation method, wire-cylinder DBD reactor

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(9)

Characterization of surface dielectric barrier discharge influenced by intermediate frequency for ozone production

A. Abdelaziz, T. Ishijima, T. Seto, N. Osawa, H. Wedaa, Y. Otani

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