

パルス変調誘導熱プラズマを用いたSF₆,N₂ガス消弧性能の検証

メタデータ	言語: Japanese 出版者: 公開日: 2021-09-13 キーワード: 作成者: メールアドレス: 所属:
URL	https://doi.org/10.24517/00063946

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1999 Fiscal Year Final Research Report Summary

Investigation for arc quenching ability of SF₆-ED2 and N₂-ED2 using pulse modulated induction plasma

Research Project

Project/Area Number

10450103

Research Category

Grant-in-Aid for Scientific Research (B)

Allocation Type

Single-year Grants

Section

一般

Research Field

電力工学・電気機器工学

Research Institution

Kanazawa University

Principal Investigator

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Project Period (FY)

1998 - 1999

Keywords

Plasma quenching ability / Inductively coupled thermal plasma / Pulse modulated mode / Transport properties / Dynamic response time / Temperature

Research Abstract

On the Basis of the successive results of generating a wide area induction plasma by using MOSFET inverter with 450-kHz frequency and 50-kW power in 1998, the further experiments were carried out in the final year of the project, 1999, as follows.

1) Generation of Atmospheric Induction Thermal plasma for SF₆-ED2 and N₂-ED2

Induction plasma for SF₆-ED2 gas medium which has a strong plasma quenching property was, for the first time, generated in inductively coupled mode at atmospheric pressure in this project. The power level was increased from 50 to 200kW, which gives a possibility to do the experiment for high pressure and high power condition equivalent to the actual circuit breaker interruption phenomena.

2) Operation of Pulse Modulated Induction Plasma

The most important facility to proceed this project, the pulse modulated induction thermal plasma, can be generated under several conditions with respect to the pressure (up to 0.1 Mpa), the duty factor and the shimmer current level (down to 40%). The rise and fall time of pulsing is as short as hundreds μ s which gives almost ideal pulse-like disturbance to the plasma. It is found that the new facility thus developed gives a detail of dynamic decaying process of high pressure plasmas of N₂/O₂, H₂/N₂ and SF₆/N₂ in repetitive mode.

3) Measurement of SF₆/N₂ Induction Plasma Temperature

The multi-channel detection of the spectrum line from Ar-SF₆ and Ar-N₂ induction plasma reveals that the SF₆ inclusion gives a strong shrinkage and reduction of the plasma temperature as prospected, while such effects are not enough in the case of N₂ inclusion. The results showed, however, that the increase of pressure or concentration N₂ gas gives an emphasis of above quenching effects almost equivalent to SF₆ gas.

Research Products (12 results)

All Other
All Publications

[Publications] 作田、田中、香月、石垣: "パルス変調された高周波誘導熱プラズマの発生"日本金属学会誌. 63. 2-8 (1999) ▼

[Publications] Y. Tanaka, K. C. Paul and T. Sakuta: "Thermodynamic and transport properties of N₂/O₂ mixtures at different admixture ratios"Trans. IEE of Japan. 120-B. 24-30 (2000) ▼

[Publications] G. J. Cliteur, K. Suzuki, Y. Tanaka, T. Sakuta, T. Matsubara, Y. Yokomizu and T. Matsumura: "On the determination of the multi-temperature SF₆ plasma composition"Journal of Physics D : Applied Physics. 32. 1851-1856 (1999) ▼

[Publications] T. Sakuta, Y. Tanaka, K. C. Paul and T. Ishigaki: "Introduction of pulse modulation into induction thermal plasma for processing under non-equilibrium condition"Proc. Int. Japan-China Bilateral Symp. on Advanced Materials Engineering. 50-57 (1999) ▼

[Publications] T. Sakuta: "Non-equilibrium effects in pulse modulated induction thermal plasma for advanced material processing"Proc. 14th Int. Symp. on Plasma Chemistry. I. 14-16 (1999) ▼

[Publications] Y. Tanaka and T. Sakuta: ▼

[Publications] T. Sakuta, Y. Tanaka, M. Katsuki and T. Ishigaki: "Generation of inductively coupled thermal plasma with pulse modulated mode"J. Japan Inst. Metals.. Vol. 63, No. 1. 2-8 (1999) ▼

[Publications] Y. Tanaka, K. C. Paul and T. Sakuta: "Thermodynamic and transport properties of N₂/O₂ mixtures at different admixture ratios"Trans. IEE of Japan. Vol. 120-B. 24-30 (2000) ▼

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URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-10450103/104501031999kenkyu_seika_hokoku

Published: 2001-10-22