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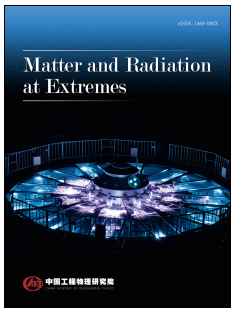

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Research Article

High Current Pulse Forming Network Switched by Static Induction Thyristor.

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Abstract

A high-current pulse forming network (PFN) has been developed for applications to artificial solar-wind generation. It is switched by static-induction thyristor (SIThy) and is capable of generating pulsed current of ~ 9.7 kA for a time duration of ~ 1 ms. The SIThy switch module is made that it can be controlled by an optical signal and it can be operated at elevated electrical potential. The experiments reported in this paper used two switch modules connected in series for maximum operating voltage of 3.5 kV. The experimental results have demonstrated a pulsed high-current generator switched by semiconductor devices, as well as the control and operation of SIThy for pulsed power application.

PACS codes: 84.70.+p; 94.05.Rx; 85.30.Rs
Keywords: Pulsed power; Pulse forming network; Power semiconductor device; Thyristor, High voltage

1. Introduction

Pulsed power is electrical energy released in a very short period. It is characterized by instantaneous high power and short pulses. It has applications in a variety of fields including material, environment, accelerator, space, and bio-medical science.[1~6)]

One of the potential pulsed-power applications is the artificial solar-wind generation, which is being developed as a research platform for studying magnetic sail. It requires a pulsed power source that can drive a current on the order of 10 kA for at least a few milliseconds.[7~9)]

Switching devices are the key components in pulsed power generators. Traditional high-current switches are either spark gaps or ignitrons, but they are not suitable for applications that require repetitive and stable performance. Solid-state switches are more preferable, especially semiconductor devices. Although semiconductor power devices have been widely used in pulsed power circuits,[10~13)] those with high-current capability are not so popular because of the limitations in the current density that can be switched by a semiconductor. Among various types of semiconductor power devices, thyristors are relatively high current-capable switches due to their special junction structure, especially the static-induction thyristor (SIThy) which has balanced specifications between switching speed and current capability.[14~16)]

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