Contribution ID: **281** Type: **Poster**

A High Power Charging Power Supply for Capacitive Pulsed Power System

Wednesday, 21 June 2017 13:30 (1h 30m)

High pulsed magnetic field, particle accelerator, strong laser, electromagnetic emission and other pulsed power system require capacitive energy with short duration and high density. It is necessary to recharge the capacitor to specific voltage by capacitor charging power supply after the discharge of energy stored in the capacitor. Charging power supply applied in high power capacitive pulsed power system has the characteristics of high voltage, large charging current and high efficiency, and such characteristics provide opportunities and challenges to its research and development. At Wuhan National Magnetic Field Center (WHFMC), a scheme of large power charging power supply applied in capacitive pulsed power system for high pulsed magnetic field is proposed with parameters of 35 kV rated voltage, 1020 A maximum current and 11.2 MW peak power. Multiple BUCK circuit topology is employed to reduce charging current ripple and each BUCK circuit operates reliably in critical continuous current mode to eliminate the overvoltage caused by reverse recovery of fly-wheel diode. Charging switch consists of 10 IGBT connected in series directly while snubber circuit ensures the effectiveness of average voltage distribution. The control strategy combining current limited control and power limited control is adopted to reduce the original capacity requirements of DC power supply and increase the charging efficiency. Simulation model of the proposed charging power supply is established that simulation result shows the validity and feasibility of the scheme. Details of the charging power supply prototype is demonstrated in this paper. According to experimental result, the charging power supply has been proven to be effective in high power capacitive pulsed power system.
Acknowledgements: The National key research and development program of China (2016YFA0401702) and the Program for New Century Excellent Talents in University.

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Session Classification: Poster session III - High Power Electronics

Track Classification: High Power Electronics