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Author: Mr. dongdong ye

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, yeddon@126.com

Mr. Qingfeng Hou

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, 13521630594@163.com

Mr. Haijun Lei

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, leihjky@163.com

Mr. Wei Zheng

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, zhengweiyhp@126.com

Mr. Cheng Zhou

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, zhoucheng0208@163.com

Dr. Ge Wang

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, wangge522@sina.com

Mr. Yuntian Cong

Beijing Institute of Control Engineering, Beijing, 100080, P.R. China, China, 15201169466@139.com

Prof. Jie Yang

Northeastern University, China, yangjie@mail.neu.edu.cn

DEVELOPMENT OF POWER PROCESSING TECHNOLOGIES FOR
MAGNETO-PLASMA-DYNAMIC THRUSTERS

Abstract

Hundreds of kilowatts would be needed for Magneto-Plasma-Dynamic (MPD) thrusters to keep highest thrust densities. A MPD thruster was firstly supplied by a ground power processing unit (PPU), which contained three types of Alternating Current to Direct Current (AC-DC) converters. The dynamic electrical characteristics of MPD thruster were given under various modes. Based on this, a PPU space prototype for a 20 kilowatts (kW) MPD thruster is under development. The unit produces up to 200 Ampere DC (ADC) with two parallel 10 kW anode supplies that operate from a 300 Volt DC (VDC) input voltage. Silicon Carbide power MOSFETs were used in this unit for high voltage stress, large current, high efficiency and low mass. Efficiencies of 96.2 percents were demonstrated during testing with the 20 kW MPD thruster. Electromagnet and ignition supplies were also developed and will be integrated with the anode supplies into a vacuum-rated power processing unit prototype with full flight functionality. This unit will be evolved into a future spacecraft for deep space missions that require electric propulsion.