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5P64 - Development of High Voltage Power Supply for The Upgrade KSTAR Helicon Current Drive System

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A new off-axis current driving method for high electron beta plasma using Helicon wave have been experimentally demonstrated in the KSTAR tokamak. Low power level coupling experimental analysis was performed in the KSTAR tokamak under various plasma conditions using traveling wave antenna, and moderate coupling and load-resilient characteristics were confirmed. Currently, KSTAR aims to upgrade the system to inject the 1MW helicon wave in 2019 campaign. This system requires a high power klystron and power supply. As a source of RF, we will use klystron which can output power 1MW at 476MHz.

A 5.9MW (92kV/64A) DC power supply system was developed for the 476MHz Helicon current drive system in KSTAR. The power supply is capable of supplying a maximum voltage of -92kV and a total current of 64A (32A, 2ea) to the cathode with respect to the collector using Pulse Step Modulator(PSM). This power supply system will be operated for two 1MW klystron units. The power supply switching circuits of PSM were made by fast IGBT which can turn off the high voltage within 5us in situation of klystron breakdown. In addition, HVS using IGBT device was configured at the output end to reduce the arc energy delivered to the load to 5J or less when the output short circuit or breakdown occurs. The output voltage is coarse adjustment by PSM, and the fine adjustment is controlled by the ripple control module.

Currently, manufacturing and testing of individual components of this power supply have been completed. Future plans are to perform a load test of the full power supply system and an output test by connecting to the klystron.

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