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## P2.091 Design of acceleration grid power supply for CFETR negative-ion-based neutral beam injection prototype

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In order to form an independent capacity of design and engineering construction for negative-ion-based neutral beam injection (N-NBI) system, and lay the foundation for the construction of Chinese Fusion Engineering Testing Reactor (CFETR). China has started the research and development of the N-NBI prototype for CFETR. The prototype is designed to accelerate hydrogen negative ions up to  $-200\text{keV}$  with a beam current as high as  $20\text{A}$  for  $3600\text{s}$ , and need an acceleration grid power supply (AGPS) rated at  $200\text{kV}/25\text{A}/3600\text{s}$ .

A single stage inverter-type high voltage power supply, which is powered by  $10\text{kV}$  ac power grid, is applied as AGPS of the N-NBI prototype. The AGPS includes a controlled rectification system, which is composed of a step-down transformer system and a 24 pulse rectifier based on thyristor. The controlled rectification system converts the ac  $10\text{kV}$  of the power grid into dc  $5000\text{V}$  to feed a dual-dc-link system. This dual-dc-link feeds a three phase three level (TPTL) neutral point clamped (NPC) dc/ac inverter which based on injection enhanced gate transistor (IEGT) and regulated by duty cycle modulation with an inverter frequency of  $150\text{Hz}$ . At the output of the inverter, a set-up transformer with turn ratio of  $1:23.6$  is used to increase the voltage level and to provide the required insulation between high voltage side and low voltage side. A high voltage uncontrolled rectifier based on avalanche diode transforms the ac high voltage of the transformer output into dc high voltage. And a high voltage R-C dc-filter smooths the dc output voltage.

This paper describes the detailed design of the AGPS for CFETR N-NBI prototype, focusing on the inverter, the step-up transformer and the high voltage diode rectifier. And the reliability of the design is verified by circuit simulations and electromagnetic simulations.

**Presenter:** ZHANG, Xueliang (State Key Laboratory of Advanced Electromagnetic Engineering and Technology School of Electrical and Electronic Engineering Huazhong University of Science and Technology)

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