Contribution ID: **484** Type: **Poster**

The Proposed Improvement for Neutral Beam Injection Power Supply System

Wednesday 7 June 2017 13:40 (2 hours)

Since the construction of previous generations of fusion reactors, new technology has emerged that can enhance the performance of the high power, power supplies (HPPS) used in fusion energy. For example, wide bandgap (WBG) based switching devices have emerged with ratings suitable for some elements of power conversion. Furthermore, modular multilevel converters (MMC) are a topology that have gained in popularity and are maturing quickly. This research explores utilizing both of these technologies in the HPPS for the auxiliary heating systems of a tokamak reactor. The Experimental Advanced Superconducting Tokamak (EAST) is used as a case study for this work. Although the results are applicable to other tokamak based fusion energy systems.

WBG devices have a unique molecular structure that enables power devices to be created with lower on-resistance. Additionally, WBG components have faster switching speeds and that reduces switching losses. In addition to these advantages, WBG devices have the potential to realize higher breakdown voltages. This makes them an attractive candidate for implementation into alternative topologies for the HPPS, such as MMCs. This work extends that study presented in to include the entire power supply module (PSM) and considers the benefits of using WBG components in all of the auxiliary heating systems.

The current neutral beam injectors (NBI) require a 100 kV/100A HPPS. By utilizing an MMC topology over the existing method, several advantages can be realized. A single MMC can eliminate all but one of the transformers that are used in the existing NBI supply and it eliminates the rectifiers in the power supply modules (PSM). Additionally, it is possible for the MMC to act as a power supply and harmonic filter hybrid. The inclusion of WBG power devices into an MMC also provides opportunities to modify the existing submodule construction.

The final paper will analyze the impact of using WBG components in the existing auxiliary heating systems. It will examine how an MMC based rectifier can be used instead of the existing power supply topology. It present methods for using the MMC rectifier as a power supply and a harmonic filter. Finally, it presents the benefits achieved by combining all three of these technologies.

Eligible for student paper award?

Yes

Authors: Ms JIANG, Zhen (MIAMI UNIVERISTY); Mr LOWDER, Austin (Miami University); Ms LIAO, Yixing (MIAMI UNIVERSITY); Mr MENG, Jiawei (MIAMI UNIVERISITY); Mr BAI, Yujie (MIAMI UNIVERSITY); Dr SCOTT, Mark (Miami University)

Presenter: Mr LOWDER, Austin (Miami University)

Session Classification: W.POS: Poster Session W

Track Classification: Power supply systems