Contribution ID: **734** Contribution code: **TUE-PO1-106-03** Type: **Poster**

Fabrication and Test of a 1:4 Scaled HTS Coil for the Defocusing Magnet of a 2 GeV FFAG Accelerator

Tuesday 16 November 2021 13:15 (20 minutes)

A new solution for cost effective, high average power (2 GeV, 6 MW) proton accelerator has been proposed and studied since 2013. The energy limit of isochronous accelerator has been successfully increased from 1GeV to 2GeV. In 2019, China Institute of Atomic Energy (CIAE) started the design of a 2 GeV FFAG accelerator and launched the preliminary study on the design of a high-temperature superconducting magnet and several other key components, e.g. the high power cavity. In order to carry out a further study for the thermal stability and the electromagnetic characteristics during the excitation of the none insulation HTS coil, and more importantly for the manufacturing process of the spiral-shaped magnet with concave edges, a 1:4 scaled HTS model magnet is being developed. We will first describe in detail the design scheme of the 1:4 scale model and the winding process of the concave coil. Then, simulations of the terminal voltage variation and the magnetic field variation of a double pancake coil during magnetic excitation are performed through a reasonable improvement of an equivalent circuit network model and the test results of single double-pancake coil are also outlined. These results are much helpful for the manufacture of the final full size superconducting magnets of the 2 GeV FFAG accelerator.

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Session Classification: TUE-PO1-106 Accelerator Magnets IV: HTS