Contribution ID: **51** Contribution code: **WED-PO2-204-08** Type: **Poster**

Novel HTS magnet design for nuclear fusion

Wednesday 17 November 2021 10:30 (20 minutes)

Nuclear fusion, regarded as a promising and infinite energy resource, is under rapid development. Associated with multiple essential advantages, such as carbon free, low land use, unlimited fuel and very low manageable waste, a number of high quality and multinational fusion projects are under construction. Tokamak, as an essential device for plasma confinement, is a key focus investigated globally. Designs of tokamak are various and they are mainly made of normal conductor (e.g. copper), low temperature superconductor (LTS) and high temperature superconductor (HTS). The tokamaks made of normal conductors are used for research, since high energy loss and heat only allows operations to last few seconds. LTS and HTS tokamaks are expected to be able to operate commercially in steady consistent operations, including ITER, DEMO, EAST, KSTAR for LTS and SPARC, CRAFT, Tokamak Energy for HTS.
This paper would focus on HTS tokamak magnets and present a novel design for the spherical tokamak developed for commercial operations. The novel design will solve several ground challenges including HTS-HTS joints for demountable structure, magnet control for auto plasma confinement, demand for high power supplies, and reliability monitoring.

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Session Classification: WED-PO2-204 Fusion IV: HTS conductors and coils