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The progress of the SUNIST-2 spherical tokamak

SUNIST-2 is the successor of the SUNIST spherical tokamak (ST). The major objective of SUNIST-2 is to investigate multiple startup and heating methods of ST with higher magnetic field. The major/minor radius of SUNIST-2, of which toroidal field can be up to 1 tesla, are 0.525/0.325 meters respectively. The vacuum vessel is relatively large when compared to the size of plasmas, it has an outer diameter of 2.27 m. The extra space is reserved for the antennas of radio frequency waves. All coils of SUNIST-2 are made by copper. The toroidal field coil has 24 turns with current up to 110 kA. The central solenoid, although it is not very suitable for reactors, is kept and strengthened in SUNIST-2 as a simple but powerful startup, heating and current drive actuator. Six separately powered sub solenoids make up the central solenoid, which bring a lot of flexibilities, lower down the voltage and ease the requirements of insulation. A pair of divertor coils are attached radially at the top and the bottom of the central solenoid. The separated central solenoids and the divertor coils enable a normal ohmic discharge mode (OH mode) and a doublet mode (DB mode) for SUNIST-2. There are 6 pair of poloidal field coils in SUNIST-2. One pair of them are located inside the vacuum vessel to initiate plasmas by merging-compression (MC mode). This pair of coils can be moved vertically and keep away from the major plasma volume if other operation modes are utilized. The other five pairs of poloidal field coils are located at the outside of the vacuum vessel.

The concept design and the engineering design of SUNIST-2 have been finished. The vacuum vessel and the coils are being manufactured. The power supply of coils based on super capacitors (TF) and electrolytic capacitors (CS and PF) are being tested. Basic diagnostics are being designed. The first plasma of SUNIST-2 is expected at the end of 2020.

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