Contribution ID: **46** Type: **oral**

Investigation of ion heating/transport process of magnetic reconnection during CS-free merging plasma startup of spherical tokamak in TS-6

Tuesday, 29 October 2019 12:20 (20 minutes)

Ion heating/transport process of CS-free merging plasma startup through magnetic reconnection has been investigated in the TS-3U (TS-6) spherical tokamak using ultra-high resolution 96CH/320CH 2D ion Doppler tomography diagnostics. In addition to the previously reported high-temperature plasma startup up to ∼250eV in TS-3 and ∼1.2keV in MAST, this research focused on the detailed characteristics of high guide field reconnection ($B_t > 3B_{rec}$) motivated by MAST merging/compression experiment which demonstrates promising performance for the connection to a quasi-steady scenario and pioneers a new frontier for reconnection studies: fine structure formation by reconnection heating. By identifying the double-axis field configuration with the X-point on the midplane using in situ magnetic probe diagnostics, the detailed measurement successfully revealed that the ion temperature profile forms two types of characteristic heating structure, both around the X-point and downstream. The former is affected by the Hall effect to form a tilted heating profile, while the latter is affected by the transport process which a forms a poloidal double-ring-like structure. The achieved ion heating mostly depends on the reconnecting component of the magnetic field, and the contribution of the guide field to decrease the heating efficiency tends to be saturated in the high guide field regime. Under the influence of better toroidal confinement with higher guide field, the downstream ion heating is transported vertically, mostly by parallel heat conduction, and finally forms a poloidal ring-like hollow distribution aligned with the closed flux surface at the end of merging.
[1] H. Tanabe et.al., Phys. Rev. Lett. 115, 215004 (2015)
[2] H. Tanabe et al, Nucl. Fusion 59, 086041 (2019)

Primary author: Dr TANABE, Hiroshi (University of Tokyo)

Co-authors: Mrs CAO, Qinghong (University of Tokyo); Mr TANAKA, Haruaki (University of Tokyo); Mr AHMADI, Tara (University of Tokyo); Ms AKIMITSU, Moe (University of Tokyo); Prof. INOMOTO, Michiaki (University of Tokyo); ONO, Yasushi (University of Tokyo)

Presenter: Dr TANABE, Hiroshi (University of Tokyo)

Session Classification: Session 03