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Heating Properties of Merging Startup in TS-3/4/5 High-Beta ST Experiments YASUSHI ONO, EIICHIRO KAWAMORI, ALEXANDER BALANDIN, University of Tokyo, TS-3/4/5 GROUP TEAM — Cause and mechanism for high-power reconnection heating studied using merging startup of two STs in the TS-3/4/5 experiments. Our 2-D ion temperature (Ti) measurement by three polychrometors with ICCD cameras revealed two hot-Ti spots in the reconnection outflow (downstream) regions. The bipolar reconnection outflow was observed to collide with the reconnected field lines, forming fast shock structures that satisfied the Rankin-Hugoniot's condition. The reconnection transformed a part of poloidal magnetic energy of merging STs into their thermal energy probably through the fast shock/ viscosity damping of reconnection outflow. The ion heating energy as well as the merging speed was observed to increase inversely with toroidal (guiding) field component Bt of the merging STs. As Bt was decreased, ion gyroradius increased and finally exceeded the sheet thickness during sheet compression of the ST merging. It caused the significant increase in sheet resistivity, reconnection speed and outflow speed that directly determined the ion heating power of merging. Another finding was rapid decrease in beta of low-q ST right after its reconnection heating. This high-beta collapse is related with the Taylor relaxation to force-free equilibria of spheromak and low-q tokamak On the other hand, the high-q ST was observed to confine most of thermal energy injected by the reconnection heating. Consequently, final beta of the merging ST increased with Bt after this high-beta relaxation.

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