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Macroscopic MHD instabilities during current ramp-up phase under the operational constraints of superconducting coils[1] YONGKYOON IN, FAR-TECH, Inc., J.G. BAK, Y.M. JEON, J. KIM, W.C. KIM, W.H. KO, K.D. LEE, S.G. LEE, S.W. YOON, NFRI, AND THE KSTAR TEAM — Inductive current ramp-up rates in the superconducting devices are quite constrained to remain much lower primarily due to the operational safety of the superconducting coils than in conventional tokamaks. A systematic study in KSTAR showed that higher current ramp-up rates tended to destabilize global MHDs more easily. On the other hand, high current ramp-up rates are also thought to have been accompanied by hollowed pressure (or temperature) profiles, in that the current diffusion time, which is proportional to $T_e^{3/2}$, at high current ramp up rates becomes much longer than at other low current ramp up rates. Considering that the hollowness, rather than current ramp-up rates, was highly correlated with the macroscopic MHDs at a similar study in C-Mod [1], both current ramp-up rates and hollowness are being investigated to address the causality of these MHDs. The understanding of the destabilization mechanism of MHDs in the current ramp-up phase of superconducting devices, in comparison with other conventional devices, will reinforce the physics basis for the technical constraints that would be imposed on the start-up scenario of ITER and future reactors to be equipped with superconducting coils.

[1] Y. In, PhD thesis, MIT (2000).

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