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Hysteresis and Back Transitions in Internal Transport Barriers S.S. KIM, HOGUN JHANG, L. TERZOLO, J.Y. KIM, J.M. KWON, National Fusion Research Institute, P.H. DIAMOND, M. MALKOV, University of California, San Diego, T.S. HAHM, Princeton Plasma Physics Laboratory — Understanding and control of the transport barrier formation and back transition are essential to achieve the optimized plasma operation and performance in tokamak plasmas. Back transition dynamics, in particular, is complicated due to the phenomenon of hysteresis, whereby the barrier state persists when the driving power is lowered below the initial threshold value. Here we report new results from theoretical and computational studies of hysteresis in internal transport barrier (ITB) with reversed magnetic shear. A revised version of the global gyrofluid TRB code has been used to study ITG turbulence. ITB formation, back transition, and hysteresis are manifested during slow ramp-ups/downs of the central heating power. Comparisons are made of the similarity/difference in the characteristics of hysteresis when the control parameter is lowered dynamically. The strength of hysteresis is quantified as functions of ion Nusselt number, q-profile shape and lower order rational q surface. In addition to the computational study, an analytical study of a two-field model of pressure and density dynamics is presented for a reversed shear ITB plasma by extending a previous theory that is applied to the edge pedestal.

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