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A newly discovered role of self-electric fields to ohmic breakdown in a Toakamk MIN-GU YOO, JEONGWON LEE, YOUNG-GI KIM, YONG-SU NA, Seoul National University — The ohmic breakdown is one of the general methods to initiate the plasma in a tokamak. During the process of inducing the toroidal electric fields to generate electron avalanche, time-varying complicated electromagnetic structures are produced in the tokamak. The physical mechanism of the ohmic breakdown has not been revealed clearly due to these complexities. Especially, self-electric fields, produced by space-charges in the plasma, have been paid little attention so that their magnitude has been assumed to be negligible. During the ohmic breakdown, however, the exponentially growing plasma density becomes high enough to produce strong self-electric fields much larger than the external toroidal electric fields. Therefore, the self-electric fields must be considered to understand the ohmic breakdown physics properly. For this purpose, a particle simulation code BREAK has been developed and applied to various ohmic breakdown scenarios to investigate unrevealed physical mechanisms self-consistently and systematically under the realistic complex circumstances. As a result, significant roles of the self-electric fields, such as decrease of the plasma density growth rate and enhancement of the perpendicular transports by ExB drifts, are newly discovered.

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