



IAEA FEC 201

Contribution ID: 298

Type: Poster

Core-edge coupled predictive modeling of JT-60SA high-beta steady-state plasma with impurity accumulation

Tuesday, 18 October 2016 14:00 (4h 45m)

The integrated modeling code TOPICS has been extended to couple impurity transports in core and scrape-off-layer / divertor regions, and applied to predictive modeling of JT-60SA high-beta steady-state plasma with the accumulation of impurity seeded to reduce divertor heat load. Consistent evaluation of impurity transport from the edge to the core clarified the compatibility of impurity seeding with the core plasma with high-beta ($\beta_N > 3.5$) and full current drive condition, i.e., when the Ar seeding reduces the divertor heat load below 10 MW/m^2 , its accumulation in the core is so moderate that the core plasma performance can be recovered by additional heating within the machine capability to compensate the Ar radiation. Validating anomalous heat transport models with JT-60U experiments and judging the applicability of models to the conservative prediction, which considers a lower bound of plasma performance, improved the above prediction reliability.

Paper Number

TH/P2-19

Country or International Organization

Japan

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Session Classification: Poster 2

Track Classification: THC - Magnetic Confinement Theory and Modelling: Confinement