Comparative Analysis of Electron Heat Transport of JET plasmas with C wall and ITER-like wall

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Deterioration of global confinement in JET experiments has been observed after the substitution of all carbon Plasma Facing Components (PFCs) with an all metal wall, so called ITER-Like Wall (ILW)[1]. Although in large part this has to be attributed to the degradation of edge confinement, as lower T_e is observed at the top of the edge pedestal in JET-ILW, comparative investigation of core electron heat transport between JET-ILW and JET-C is needed to assess whether core confinement has also been affected.

The results presented here have been obtained analysing a set of discharges consisting of H-mode plasmas in JET-ILW and their counterpart discharges in JET-C having similar global operation parameters (I_p,B_t,$P_{NBI,}$ $<n_{e>}$, and q_{95}). Based on T_e profile analysis using High Resolution Thomson Scattering (HRTS) data, the T_e profile peakedness (i.e. core T_e (ρ=0.4) / edge T_e (ρ =0.8)) is maintained in JET-ILW, regardless of edge T_e. This enables us to make an extrapolation, which predicts similar core T_e in JET-ILW if edge T_e is recovered to a comparable value in JET-C.

A possible explanation on the core T_e prediction is provided using TRANSP results, which are performed under assumption of T_i=T_e. The electron conductive heat flux calculated by TRANSP increases strongly after a certain threshold value in R/L_{Te} (i.e. the inverse T_e gradient length ~ $\nabla T_e/T_e$) as expected by micro-instability induced turbulence theory[2,3]. Furthermore, both JET-ILW and JET-C plasmas have a similar R/L_{Te} threshold. This implies that in terms of anomalous electron heat transport the core confinement property in JET-ILW is not degraded compared to that in JET-C.

TRANSP also shows consistent results on electron heat conductivity χ_e at the core. JET-ILW shots have similar or higher χ_e than in C wall, but extrapolation based on the trend of ∇T_e with edge T_e predicts larger ∇T_e in JET-ILW at similar edge T_e with JET-C. If one could obtain high edge T_e while keeping the same core confinement, then the core χ_e would be in a similar range in present ILW discharges.

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