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Modeling of limiter heat loads and impurity transport in Wendelstein 7-X startup plasmas[1] FLORIAN EFFENBERG, UW Madison, Y. FENG, IPP Greifswald, H. FRERICHS, O. SCHMITZ, UW Madison, H. HOELBE, R. KOENIG, M. KRYCHOWIAK, T.S. PEDERSEN, S. BOZHENKOV, IPP Greifswald, D. REITER, FZJ — The quasi-isodynamic stellarator Wendelstein 7-X starts plasma operation in a limiter configuration. The field consists of closed magnetic flux surfaces avoiding magnetic islands in the plasma boundary. Because of the small size of the limiters and the absence of wall-protecting elements in this phase, limiter heat loads and impurity generation due to plasma surface interaction become a concern. These issues are studied with the 3D fluid plasma edge and kinetic neutral transport code EMC3-Eirene. It is shown that the 3D SOL consists of three separate helical magnetic flux bundles of different field line connection lengths. A density scan at input power of 4MW reveals a strong modulation of the plasma paramters with the connection length. The limiter peak heat fluxes drop from 14 MWm^{-2} down to 10 MWm^{-2} with raising the density from $1{\times}10^{18}\mathrm{m}^{-3}$ to $1.9{\times}10^{19}\mathrm{m}^{-3}$, accompanied by an increase of the heat flux channel widths λ_q. Radiative power losses can help to avoid thermal overloads of the limiters at the upper margin of the heating power. The power removal feasibility of the intrinsic carbon and other extrinsic light impurities via active gas injection is discussed as a preparation of this method for island divertor operation.

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