

# Simulation study of the radiative divertor of different seeded impurity species for CFETR

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The fusion power of China Fusion Engineering Test Reactor (CFETR) [1] is proposed to achieve the level of gigawatt, which implies the critical issue of power exhaust by divertor. Impurity radiation is an effective way to reduce the heat load onto the divertor target. For CFETR, to reduce the tritium retention and increase the lifetime of plasma-facing components, full-tungsten wall would be the prior choice, which means there is not any intrinsic radiative impurities. Therefore, impurity seeding is indispensable for CFETR. It is necessary to explore the reasonable impurity seeding scheme to achieve good performance of radiative divertor, where a high radiation fraction can be achieved to reduce the heat load and the upstream impurity concentration can be kept as low as possible to avoid degradation of the performance.

In this work, SOLPS simulation are performed for the radiative divertor with different radiative impurity species, including nitrogen, neon and argon. For a radiation fraction of ~85%, the boundary plasma is simulated with different density. A comparison of the radiative efficiency  $H$ , which is defined by the radiative fraction divided by  $Z_{\text{eff}}-1$ , shows  $H_{\text{N}} > H_{\text{Ar}} > H_{\text{Ne}}$ . Further analysis shows that, the residence time is longer for the impurity of higher ionization potential, which implies the non-coronal effect is more significant for the impurity species of lower ionization potential. The  $n_e$ ,  $Z_{\text{eff}}$  and Prad from SOLPS simulations are then fitted according to a modified Matthews' form [2], where the influence of ionization potential of impurity species is included.

## Reference

- [1] Y.X. Wan, et al., Nucl. Fusion 57 (2017) 102009.
- [2] G.F. Matthews, et al., J. Nucl. Mater. 241-243 (1997) 450-455.

## Country or International Organization

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