Modeling Fuel Retention in Tungsten Plasma-Facing Materials under realistic Tokamak operation including Plasma Impurities

MPT/P5-29

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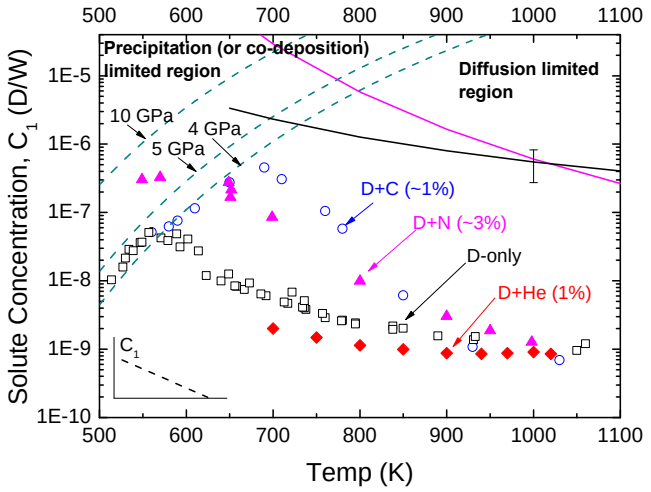
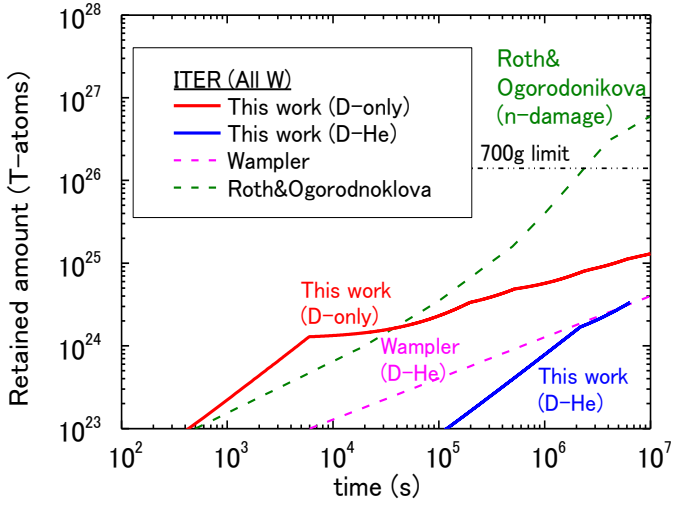
- This study outlines a new approach in modelling in-vessel Tritium inventory in tungsten (W) by using near surface solute concentration to parameterize transport behaviour compared to scaling laws derived from retention studies.
- It is empirically based on near surface solute concentration measurements from laboratory mixed ion-driven permeation experiments.
- **Nitrogen:** Two regimes are identified under divertor conditions (precipitation or diffusion limited) which is predicted to occur at T ~ 800 K.
- **Helium:** Transport parameters (recombination and diffusion coefficient) is fitted using TMAP7 code and used to predict T retention in divertor. Under divertor conditions, only a systematic decrease is expected due to a decrease in inwards flux, but first wall conditions will result in shift from diffusion to recombination limited regime.

Nitrogen impurity



Helium impurity



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