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P2.114 Effect of carbon impurity reduction on Hydrogen isotope retention in QUEST high temperature wall

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The elucidation of hydrogen recycling in plasma facing materials is one of key issues to sustain the steady state plasma during fusion operation. QUEST (Q-shu University Experiment with Steady-State Spherical Tokamak) is operated by only hydrogen plasma with all metal plasma facing wall under higher wall temperature of 473 K. However, a mixed material deposition layers contained with carbon, were formed on the top surface of plasma facing walls after the plasma experiments, which would change the hydrogen isotope retention characteristics. Recently, the amount of carbon was remarkably reduced, and surface structure was clearly changed. Therefore, this study focuses on the effect of mixed material deposition layer on hydrogen isotope retention in large plasma device, QUEST under high temperature wall.

The W samples were installed in the plasma facing walls (Top, Equatorial and Bottom positions) of QUEST and exposed more than 4000 shots of hydrogen plasma in each 2015AW (Autumn-Winter), 2016SS (Spring-Summer) and 2016AW campaign. After hydrogen plasma operation in QUEST, the surface chemical states and morphology were studied by XPS and TEM. The hydrogen retention was evaluated by TDS. In addition, 1 keV deuterium ion (D2+) was implanted to evaluate the enhancement of D retention by hydrogen plasma exposure.

It was found that the composition of elements in the mixed material deposition layers was clearly increased as the plasma experiment was accumulated. Major D desorption temperature for 2015AW Top sample was found at 400 K, but that for 2016SS and 2016AW Top sample was located at around 600 K, indicating that D trapping by vacancies would be the major trapping states and most of dislocation loops were recovered by high temperature wall operation. In the presentation, detail experimental results will be shown and the hydrogen isotope retention behavior in QUEST will be discussed.

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