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Collisional processes of B and BH in fusion plasmas

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Wall conditioning is essential for controlling hydrogen recycling and the amount of intrinsic impurities to achieve high-performance plasmas in magnetically confined fusion devices. A technique for wall conditioning, boronization, is coating the chamber walls with boron. To examine the effectiveness of boronization, it is essential to investigate where and how much boron is deposited onto the plasma-facing materials (PFM).
BH spectral emission is a good diagnostic of boron deposition onto PFM. BH (or boron deuteride, BD) molecular bands have been confirmed in discharges after fresh boronization. Kawate et al. (2022 NucFu) performed impurity powder-dropping experiments (Nagy et al. 2018 RScI) with boron powders in the Large Helical Device toward real-time wall conditioning. Our spatially-resolved spectroscopic measurements of BH molecular bands suggest deposition and desorption of boron on the divertor plates.
In this study, we numerically investigate electronic excitation and ionization cross sections for the eˆ- – BH and eˆ- – BHˆ+ collision processes and the rate coefficients. In addition, we derive S/XB and compare it to the preceding study, aiming for an application to plasma diagnostics and modeling near PFM in fusion devices.
The calculations were performed by the R-matrix and Binary Encounter Bethe methods utilized by Quantemol-EC software. To examine the uncertainty due to the calculation conditions, we compared the results by different basis sets and internuclear distances of the target model.
In the presentation, we introduce our experimental results by molecular spectroscopy and numerical results on electron collision processes of BH. In addition, we discuss the formation processes of BH molecules near PFM.

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