EMC3-EIRENE simulations of injected lithium transport for H-mode plasma of EAST with different upstream densities

B. Pan\textsuperscript{a}, S.Y. Dai\textsuperscript{a,*}, Z. Sun\textsuperscript{b}, G.Z. Zuo\textsuperscript{b}, J.S. Hu\textsuperscript{b}, Y. Feng\textsuperscript{c}, and D.Z. Wang\textsuperscript{a}

\textsuperscript{a} Key Laboratory of Materials Modification by Laser, Ion and Electron Beams (Ministry of Education), School of Physics, Dalian University of Technology, Dalian 116024, China
\textsuperscript{b} Institute of Plasma Physics, Chinese Academy of Sciences, Hefei 230031, People’s Republic of China
\textsuperscript{c} Max-Planck-Institute für Plasmaphysik, D-17491 Greifswald, Germany

email: daishuyu@dlut.edu.cn

Lithium (Li) is considered as a promising candidate for plasma facing materials of future fusion devices, which can be self-healing compared to solid materials [1,2]. Lithium material is able to heal itself, which is a great advantage compared to solid materials [1,2]. Li impurity has a weaker hazardous impact compared to that of high-Z impurities because Li impurity has a low charge state. In addition, the deposited Li impurity has a strong chemical activity to absorb atomic or ionic species such as carbon and oxygen, which can reduce impurity content in the background plasma. Due to these compelling characteristics, it is necessary to study edge Li impurity transport and emission properties in order to achieve a long-term and steady-state operation regime for fusion facilities.

In this work, Li injection simulations with different upstream densities have been conducted for the H-mode plasma on EAST with EMC3-EIRENE modelling [3,4]. The mean free paths of Li atoms and Li$^{1+}$ ions decrease as the upstream density. When the upstream density is higher, the Li particles become easier to ionize and more Li$^{1+}$ and Li$^{2+}$ ions populate at the upstream region. The analysis of friction and thermal forces acting on Li impurity shows that the distributions of Li$^{1+}$ and Li$^{2+}$ ions are less affected by force balance. The positions of the peak value of Li ion density approximately coincide with that of the Li particle source, indicating that ion density distribution is more affected by Li ionization and recombination processes.