Improvement of the STOR-M tokamak plasma discharge by lithium coating of the inner wall*

A. Rohollahi[1], S. Elgriw[1], J. Adegun[1], A. Mossman[2], M. Patterson[1], C. Xiao[1] and A. Hirose[1]

[1] *University of Saskatchewan, Saskatoon, Saskatchewan, Canada*

[2] *General Fusion Inc., Burnaby, British Columbia, Canada*

Increased fuel recycling and impurity in plasma due to plasma-surface-interactions are two key elements that have brought the concept of tokamak wall conditioning to the center of attention. Boronization, siliconization and lithium coating of the tokamak first wall have been used to reduce the fuel recycling and the high-Z impurities release from the tokamak wall [1]. Lithium (Li) is one of the most chemically active metallic elements with a low charge number and low melting temperature. Lithium coating has been considered as one of the attractive techniques since it is compatible with liquid wall/divertor concept with the self-healing feature. Low-Z impurities, such as oxygen and carbon, can be chemically captured by Li. The hydrogen retention of the tokamak wall can be improved significantly by Li coating.

In a recent campaign in the STOR-M tokamak (R/a = 0.46/0.12 cm, B_t =0.65 T, I_p =22 kA), 100 mg of Li has been coated inside the tokamak chamber by the vacuum evaporation technique via a single evaporator. The Li evaporator was designed and developed by General Fusion Inc.. After Li coating, reduction of plasma impurity contents has been observed. Also, the plasma current and the plasma discharge duration have been increased significantly. The line-averaged electron density in the STOR-M discharges has been reduced compared to the pre-Li coating discharges. An increase in the hard x-ray (HXR) radiation after Li coating has been measured, suggesting an enhanced portion of suprathermal run-away electrons because of the reduced electron density. The benefit of 100 mg Li coating persists for at least 200 discharges in STOR-M. STOR-M is equipped with a compact torus injector (CTI) for central fueling and plasma flow control. CTI has been utilized to make up the reduced fuel recycling and to bring the density to a nominal level which in turn reduces the HXR radiation level. This research was supported by NSERC, CRC, SFCCNI and General Fusion Inc..

Reference:

[1] Winter J 1994 Tokamak wall coatings *Plasma Phys. Contrl. Fusion* **36** B263–76