Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **18** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Design and Characterization of a Dust Injector for STOR-M

Tuesday 8 June 2021 16:05 (15 minutes)

Affiliation: University of Saskatchewan

Fusion and related plasma physics research enables the development of a new, safe and reliable, high-output fusion energy source. There are however multiple problems to address with fusion devices. One such problem is that of contaminating dust, produced by plasma wall interactions within the reactor.
Dust generation from Plasma Facing Components (PFC) is problematic for tokamaks as they approach suitable reactor conditions. Tungsten dust is especially detrimental in the plasma core, due to associated high Z bremsstrahlung power losses. As Tungsten is a primary candidate for PFC materials in large projects such as ITER, this remains a pressing issue. In order to better understand dust dynamics in tokamaks, a dust injection experiment has been developed for the Saskatchewan Torus-Modified (STOR-M). This experiment will utilize calibrated, spherical tungsten micro-particles. A known quantity of these tungsten micro-particles are to be injected into the STOR-M tokamak, with control over the position of the plume of dust particles. This will enable the study of dust dynamics and the effects of dust particles on the tokamak plasma within STOR-M.
In preparation for this experiment, a dust injector has been designed and built, based on the fast gas valve for the University of Saskatchewan Compact Torus Injector (USCTI). Additionally, an experimental test apparatus has been developed and used to characterize the dust injector.
Two dust injection schemes have been envisaged for STOR-M. The first disperses dust particles directly into the tokamak chamber, where a discharge is to commence around these particles. The second utilizes the USCTI to trap the tungsten particles in an accelerated plasmoid, in order to deliver dust particles to the core of the STOR-M plasma within a time scale of approximately 10 μs. Integration of the dust injector into the STOR-M system is currently underway.

References:

- N. Nelson. "Design and Characterization of a Dust Injector for Future Studies of Tungsten Dust in the STOR-M Plasma". Masters dissertation. University of Saskatchewan. 2020. https://harvest.usask.ca/handle/10388/13194
- J. Roth et al. "Recent analysis of key plasma wall interactions issues for ITER". In: Journal of Nuclear Materials390-391 (2009), p.1. doi:10.1016/j.jnucmat.2009.01.037.
- R. D. Smirnov et al. "Tungsten dust impact on ITER-like plasma edge". In: Physics of Plasmas 22.012506 (2015). doi:10.1063/1.4905704.
- Krasheninnikov S. I., Smirnov R. D., and Rudakov D. L. "Dust in magnetic fusion devices". In: Plasma Physics and Controlled Fusion 53(8) (2011).doi:10.1088/0741-3335/53/8/083001.

Authors: NELSON, Nathan (University of Saskatchewan); XIAO, Chijin (University of Saskatchewan); COUEDEL, Lenaic (University of Saskatchewan)

Presenter: NELSON, Nathan (University of Saskatchewan)

Session Classification: TS-3 Plasma Physics Symposium (DPP) / Symposium de physique des plasmas (DPP)

Track Classification: Symposia Day (DPP) - Low temperature plasmas/Fusion plasmas (magnetic and inertial confinement)/ Laser plasmas/Basic plasmas