



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 3341 Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

## **(G\*) High-Fluence Plasma Immersion Ion Implantation (PIII) for Fusion PFC Materials Testing**

*Wednesday 8 June 2022 14:15 (15 minutes)*

Plasma fusion devices will require plasma-facing components (PFCs) which can withstand the extreme environment at the edge of a hot fusion plasma [1]. Studies of materials suitability for fusion PFCs require experiments that can simulate the ion bombardment associated with fusion edge plasmas [2-3]. High fluence ion implantation is one tool for this purpose. The Bradley group at the University of Saskatchewan has been developing Plasma Immersion Ion Implantation (PIII) as a tool for this and other materials science applications requiring high ion fluence. High fluence ion implantation for this work is being conducted in the custom US-ask PIII system developed by the Bradley group, consisting of an Inductively Coupled Plasma and a custom high-voltage modulator [4-6]. This talk will review the physics underlying high fluence ion implantation using PIII, as well as some recent applications including those related to fusion PFC materials testing.

### References

- [1] T. Hirai et al., "Use of tungsten material for the ITER divertor", Nuclear Materials and Energy 9, pp. 616-622 (2016).
- [2] M. J. Baldwin and R. P. Doerner, "Formation of helium induced nanostructure 'fuzz' on various tungsten grades," J. Nucl. Mater. 404, no. 3, pp. 165-173 (2010).
- [3] K. Tokunaga et al., "Blister formation and deuterium retention on tungsten exposed to low energy and high flux deuterium plasma," J. Nucl. Mater., 337-339, pp. 887-891 (2005).
- [4] M. Risch and M.P. Bradley, "Prospects for Band Gap Engineering by Plasma Ion Implantation", physica status solidi (c) 6, S210-S213 (2009).
- [5] C.J.T. Steenkamp and M.P. Bradley, "Active Charge/Discharge IGBT Modulator for Marx Generator and Plasma Applications", IEEE Trans. Plasma Sci. 35, 473-478 (2007).
- [6] J. Moreno, A. Khodaei, D. Okerstrom, M.P. Bradley, and L. Couëdel, "Time-resolved evolution of plasma parameters in a plasma immersion ion implantation source", Physics of Plasmas 28, 123523 (2021).

**Authors:** Prof. BRADLEY, Michael P. (University of Saskatchewan ); Ms YOUSAF, tahreem (University of Saskatchewan )

**Presenter:** Ms YOUSAF, tahreem (University of Saskatchewan )

**Session Classification:** W2-7 Plasma-Matter interactions (DPP) | Interactions plasma-matière (DPP)

**Track Classification:** Technical Sessions / Sessions techniques: Plasma Physics / Physique des plasmas (DPP)