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

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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

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- [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).
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- [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).

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