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8.8 Helicon Power Source Analysis of the Prototype Material Exposure eXperiment (Proto-MPEX) using Fluoroptic Probes*

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Proto-MPEX is a prototype design for the Material Plasma Exposure eXperiment (MPEX), a steady-state linear device being developed to study plasma material interactions (PMI). The primary purpose of Proto-MPEX is developing plasma heating source concepts for MPEX, which include a 13.56 MHz half-turn copper helicon antenna surrounding an aluminum nitride (AlN) window, whose strong electromagnetic (EM) fields inhibit reliable data collection of the helicon region from most installed diagnostics. Fluoroptic probes (FPs) are unique thermometric diagnostics composed of an optical fiber with a temperature sensitive phosphorescent sensor tip that are immune to EM field interference. Five fluoroptic probes are installed under the antenna such that they are in thermal contact with the AlN window. These FPs estimate heat loss from the plasma under the helicon antenna via observed temperature increases on the helicon window. Analyzed in conjunction with installed thermocouples (TCs), double Langmuir probes/Mach probes (DLPs/MPs), and SOLPS modeling, the FPs quantify the helicon plasma, identifying dominant loss mechanisms for specific machine operating parameters. *This work was supported by the U.S. D.O.E. contract DE-AC05-00OR22725.

Primary author(s) : SHOWERS, M. (ORNL/UT-Knoxville)

Co-author(s) : BIEWER, T.M. (ORNL); CANESES, J.F. (ORNL); CAUGHMAN, J.B.O. (ORNL); DONOVAN, D.C. (UT-Knoxville); GOULDING, R.H. (ORNL); LUMSDAINE, A. (ORNL); KAFLE, N. (ORNL/UT-Knoxville); OWEN, L. (ORNL); RAPP, J. (ORNL)

Presenter(s) : SHOWERS, M. (ORNL/UT-Knoxville); BIEWER, T.M. (ORNL); CANESES, J.F. (ORNL); CAUGHMAN, J.B.O. (ORNL); DONOVAN, D.C. (UT-Knoxville); GOULDING, R.H. (ORNL); LUMSDAINE, A. (ORNL); KAFLE, N. (ORNL/UT-Knoxville); OWEN, L. (ORNL); RAPP, J. (ORNL)

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