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The DRGA as a burning plasma-compatible diagnostic system for time resolved monitoring of core plasma, fuel-cycle processes

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The Diagnostic Residual Gas Analyzer (DRGA), an integrated, multi-sensor diagnostic system, will access and sample the ITER sub-divertor region, in the ducts of the cryogenic pumps, out-of-site of the main plasma chamber. It will deliver time resolved neutral gas composition measurements directly related to fuel cycle processes in the core plasma, in plasma-wall equilibration timescales [1, 2]. The system will be capable of simultaneously resolving hydrogen and helium isotopic composition, with detection limits as low as 1% and 0.1%, respectively, in terms of isotopic species concentration [3]. These are critical capabilities for the ITER research program, including the pre-fusion (pre-DT) plasma operation phases. As such, they are explicitly called out in the latest version of the ITER Research Plan [4]. The ability to carry out such measurements without the need for direct access to/through the main chamber wall, or a blanket module, makes this diagnostic approach attractive for use in future, post-ITER, burning plasma fusion devices. In this work, concepts for generalization of such a diagnostic system for next step fusion devices will be discussed. The possibility to use it for fuel-cycle process control will also be explored, both for ITER and for next generation burning plasma devices.

Speaker's Affiliation

Oak Ridge National Laboratory

Member State or IGO

United States of America

Primary authors: KLEPPER, Christopher (Oak Ridge National Laboratory); RASMUSSEN, David (ORNL); LORE, Jeremy (ORNL); BIEWER, Theodore (Oak Ridge National Lab)

Presenter: KLEPPER, Christopher (Oak Ridge National Laboratory)

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