Contribution ID: **27** Type: **Contributed Poster**

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

Wednesday 12 October 2022 14:50 (20 minutes)

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.

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Session Classification: Posters

Track Classification: Interface btw Plasma Physics & Fuel Cycle Technology