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CURRENT STATUS OF THE EU DEMO VACUUM SYSTEMS

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The European DEMO programme is running an activity which aims to develop a self-consistent and fully integrated design of the Tritium, Matter Injection and Vacuum Systems, supporting a tokamak operation with a high burn-up fraction. The architecture of the DEMO fuel cycle is mainly driven by the need to reduce the tritium inventory in the systems to an absolute minimum. This requires the continual recirculation of gases in loops without storage, avoiding hold-ups of tritium in each process stage by giving preference to continuous over batch technologies.

To meet these requirements for the vacuum systems, the Direct Internal Recycling Concept (DIR) has been elaborated which separates a DT fraction from the exhaust gas and continuously feeds the matter injection systems with DT that is not being cycled through the tritium plant. Furthermore, in the technical realization of the DIR concept - the so-called KALPUREX©-process - the cryogenic pumps typically used in existing devices for torus exhaust pumping have been replaced by (i) metal foil pumps that provide the exhaust gas separation needed, and by (ii) continuously operating vacuum pumps (vapour diffusion, liquid ring) based on mercury as perfectly tritium-compatible working fluid.

This paper describes the current status of the various elements in the vacuum system development programme. The research is focused on modelling and on associated experiments for code benchmark and design support. Recent experimental results gained from mercury liquid ring pump testing and from metal foil characterisation are presented and discussed. Two alternative and fall-back technologies such as a novel multi-stage cryopump concept with gas separation and NEG pumping based on new high capacity getters will be explained.

Eligible for student paper award?

No

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