

# **Tritium extraction from liquid PbLi: a critical review of candidate technologies for ITER and DEMO applications**

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Extraction of tritium from liquid lead lithium eutectic alloy is a key topic for the feasibility of any PbLi based tritium breeding blanket. In general, high tritium extraction efficiency is necessary in order to keep the tritium concentration in the PbLi loop low with the advantage of minimizing the tritium permeation through the loop pipes and equipments into the environment and from the blanket breeding region into the primary cooling system. On the other hand, the tritium extraction system needs to be highly reliable and based on a robust technology in order not to impact negatively on the operation of the whole fusion reactor. These two requirements, which could lead to different technological choices, are valid for the Test Blanket Modules in ITER as well as the breeding blankets in DEMO.

In the present paper, a critical review of the main candidate technologies, particularly gas liquid contactors, vacuum permeators and getters, is carried out. The intrinsic limits and possible advantages for each technology are presented and discussed, in the light of considerations coming directly from mathematical models describing their behavior as well as from the most reliable experimental results so far achieved. Possible consequences in terms of tritium extraction performance due to the large uncertainty in the solubility of hydrogen in LiPb are also discussed. The last part of the paper is devoted to propose a selection of the tritium extraction system for the different PbLi based blanket concepts, for both ITER and DEMO applications.