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P3.162 Tritium transport model at breeder unit level for HCLL breeding blanket

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The Helium-Cooled Lithium Lead (HCLL) breeding blanket is one of the European blanket designs proposed for DEMO reactor. A tritium transport model is fundamental for the correct assessment of both design and safety, in order to guarantee tritium self-sufficiency and to characterise tritium concentrations, inventories and losses. The present 2D transport model takes into account a single breeder unit located in the outboard equatorial module of the HCLL breeding blanket, which is one of the most loaded modules in normal operating conditions. A multi-physics approach has been adopted considering several physics phenomena, providing for buoyancy effect, temperature fields, tritium generation rate and velocity profile of lead-lithium and coolant. The transport has been modelled considering advection-diffusion of tritium into the lead-lithium eutectic alloy, transfer of tritium from the liquid interface towards the steel (adsorption/desorption), diffusion of tritium inside the steel, transfer of tritium from the steel towards the coolant (recombination/desorption), advection-diffusion of diatomic tritium into the coolant. Moreover, a preliminary evaluation of the magneto-hydrodynamics effect (MHD) has been also performed. Tritium concentrations, inventories and losses have been derived under the above specified phenomena. Results, input and boundary conditions are illustrated in detail within the paper.

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