

An overview of dual coolant Pb-17Li breeder first wall and blanket concept development for the US ITER-TBM design

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Abstract. An attractive blanket concept for the fusion reactor is the dual coolant Pb-17Li liquid (DCLL) breeder design. Reduced activation ferritic steel (RAFS) is used as the structural material. Helium is used to cool the first wall and blanket structure, and the self-cooled breeder Pb-17Li is circulated for power conversion and for tritium breeding. A SiC_f/SiC composite insert is used as the magnetohydrodynamic (MHD) insulation to reduce the impact from the MHD pressure drop of the circulating Pb-17Li and as the thermal insulator to separate the high temperature Pb-17Li from the helium cooled RAFS structure. For the reference tokamak power reactor design, this blanket concept has the potential of satisfying the design limits of RAFS while allowing the feasibility of having a high Pb-17Li outlet temperature of 700°C. We have identified critical issues for the concept, some of which include the first wall design, the assessment of MHD effects with the SiC-composite flow coolant insert, and the extraction and control of the bred tritium from the Pb-17Li breeder. R&D programs have been proposed to address these issues. At the same time we have proposed a test plan for the DCLL ITER-Test Blanket Module program.