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Stability of mixed convection flows in poloidal ducts of DCLL blanket NAVEEN VETCHA, SERGEY SMOLENTSEV, MOHAMED ABDOU, University of California Los Angeles — In the Dual-Cooled Lead-Lithium (DCLL) blanket, which is considered in the US for testing in ITER and for using in DEMO, the eutectic alloy PbLi circulates slowly (at $\sim$ 10 cm/s) for power conversion and tritium production. The flows in the poloidal ducts are strongly affected by buoyancy effects associated with volumetric heating, the forced flow is combined with the buoyant flow resulting in a mixed regime. Under strong reactor magnetic field, the convective flows are seen to be essentially quasi-two-dimensional (Q2D), with 3-D effects localized in the Hartmann layers. This striking feature allows for using the Q2D flow model. Two-dimensional linear stability analysis of both upward and downward flows with Q2D base flow considering only thermal shear instability revealed that the internal shear layer in the base velocity profile results in a shear layer instability (primary instability), these primary vortices are found to trigger an instability in the boundary layers causing the side layers to become unstable (secondary instability). The study shows that upward flows under blanket conditions are stable considering the effects of mixed convection whereas downward flows can be unstable.

Naveen Vetcha
University of California Los Angeles

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