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Numerical simulation of the flow patterns within concentric spheres with rotation and solid-liquid phase change ARES CABELLO, RUBEN AVILA, Engineering Faculty — We present the flow patterns in the interior of a spherical annulus at different Taylor (Ta) numbers and for two Stefan (St) numbers. The equations of the two phases are solved in a Cartesian coordinate system using a spectral element method, in a reference frame that is turning with the system, then the centrifugal and Coriolis terms are considered. Firstly the Stefan number was equal to zero i.e. without solidification from the outer boundary. Secondly the St number was fixed to $St = 6 \times 10^{-3}$, hence the growing of a solid crust from the outer sphere was allowed. When the Ta number is in the range $Ta < 3 \times 10^5$ (subcritical regime), it is observed a basic flow. A transitional oscillatory stage appears when the Ta number is increased in the interval $(3 \times 10^5 < Ta < 2 \times 10^6)$. When the Ta number is increased furthermore $Ta > 2 \times 10^6$ (supercritical regime) the oscillation of the flow dissapears and a new basic flow pattern is attained with four lobes located adjacent to the equator of the spheres. The influence of the solidification from the outer sphere on the flow, has been investigated by fixing the St number to $St = 6 \times 10^{-3}$ and for Ta number $Ta = 3.6 \times 10^6$. It is observed that as the solid crust grows, the Ta number dynamically decreases however since the viscous characteristic time of the fluid is higher than the rate of crust growth, the flow pattern is not modified.

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