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Global structure transitions in an experimental induction furnace[1] YUJI TASAKA, Hokkaido University, VLADIMIR GALINDO, TOBIAS VOGT, SVEN ECKERT, Helmholtz-Zentrum Dresden-Rossendorf — Flows induced by alternating magnetic field (AMF) in a cylindrical vessel filled with liquid metal, alloy of GaInSn, were examined experimentally using ultrasonic Doppler velocimetry (UDV). Measurement lines of UDV arranged vertically set at different radial and azimuthal positions extracted flow structures and their time variations as spatio-temporal velocity maps in the opaque liquid metal layer. At low frequency of AMF, corresponding to shielding parameter $S = \mu_{\mathrm{m}}\sigma\omega R^2 = O(1)$ (μ_{m} and σ are magnetic permeability and electric conductivity of the test fluid, ω angular frequency of AMF, and R the radius of cylindrical vessel), two toroidal vortices exist in the fluid layer as the large scale flow structure and have interactions each other. With increasing of S the structure has transition from toroidal vortex pair to four large scale circulations ($S \geq 100$) via transient state, where strong interactions of two vortices are observed ($30 < S < 100$). Faster vertical stream is observed near the cylinder wall because of ski effect caused by AMF, and the time-averaged velocity of the stream takes maximum around $S = 20$, which is little smaller value of S for the onset of the transient state.

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