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Acoustic Streaming and Thermal Instability of Flow Generated by Ultrasound in a Cylindrical Container[1] ADAM GREEN, DONG MA, JEFFREY MARSHALL, JUNRU WU, The University of Vermont — A vertically orientated ultrasonic transducer contained within a closed cylindrical Pyrex tube was used to study acoustic streaming flow within in a cylindrical container. A PIV system incorporating fluorescent 1.5 micron seeding particles suspended in a mixture of Diethyle-Pthalate and Ethanol, which was indexed matched to Pyrex, was used to allow for undistorted PIV imaging within the Pyrex tube. Temperature on the end-wall surface and acoustic pressure within the cylinder were also measured for different end-wall materials. Variables considered included acoustic absorption and reflection coefficients, ultrasound intensity, container height, and thermal properties of the end-wall material. It was observed that a quasi-steady state flow field driven by acoustic streaming is rapidly established within the container, which is typically dominated by a stationary vortex ring with downward flow along the ring axis. After sufficient time this quasi-stationary flow exhibits a thermal instability causing it to transform into a secondary flow state. Different types of secondary flow states were observed, including cases where the flow along the cylinder axis is oriented upward toward the ultrasound transducer and cases where the axial flow changes directions along the cylinder axis.

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