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Brandenburg University of Technology Cottbus - Senftenberg

Offer of Master Project

DEPIK – TEHD: Experimental analysis of the convective flow induced by an effective electric gravity in a rectangular cavity

Project description:

It is well established that natural convection enhances the transport of heat between a hot surface and a cold one. Indeed, the Earth's gravity acts on the density stratification and produces the Archimedean's buoyancy, which is a source of convective heat transfer. An equivalent buoyancy mechanism can be obtained by the application of a strong alternative electric field to a non-conducting fluid. A Dielectrophoretic Induced Convection (german DEPIK) can then occur, analogously to the classical Rayleigh-Bénard instability, as seen in Figure 1. This system is of main interest for the investigation of geophysical flow or for specially designed heat exchangers.

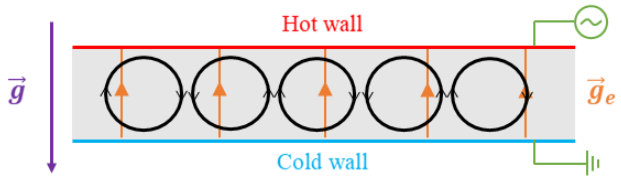

Figure 1: Schematic representation of the convective flow induced by the electric gravity $\vec{g}_e$ in a horizontal rectangular cavity.

The main objective of this master project is to identify thermo-convective pattern and to study their emergence and development for different fluids and for different cavity orientations. Different visualisation methods can be applied such as Particle Image Velocimetry, Background Oriented Schlieren, or shadowgraph method. The topic is closely related to fluid dynamics under microgravity research, and the results might be used in the framework of Parabolic Flight Campaigns and of Sounding Rocket (TEXUS) flight.

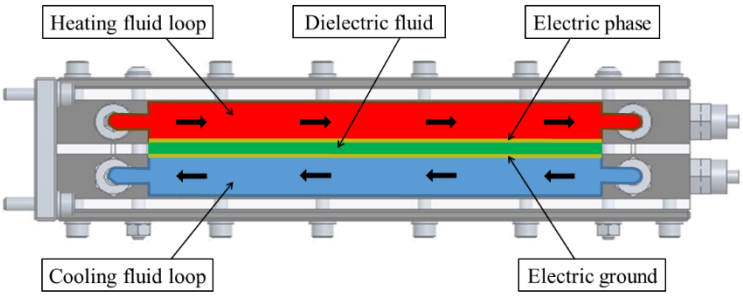

Figure 2: Mechanical drawing of the rectangular cavity. The two electrodes are maintained at different temperature with two distinct fluid loops. A high alternative electric field is applied between the two plates.

We are looking for a physics or engineering student to perform laboratory experiments (Figure 2) and data analysis of thermoelectric convective flows in a differentially heated rectangular cavity. The candidate will need to familiarize with the scientific research process by studying the bibliography, experimenting, post-treating images and data, analysing and discussing their findings.

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