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Experimental and numerical study on the influence of natural convection on the temperature fluctuation

A Gifford-McMahon (GM) cryocooler can be used in a cryostat with benefits of simple structure and low operating cost except vibration and temperature fluctuation.However, some applications are very sensitive to temperature stability at low temperature.In general,there are two ways to reduce temperature fluctuaions on cold stage of cryocooler.One is to decrease thermal diffusibility between cold stage and cooled object,another way is to increase heat capacity on cold stage.In the present work,the effect of natural convection take places in a cylinder filled with helium on temperature fluctuaion is studied both experimental and numerical.The upper wall of the cylinder is connected to the second cold stage of the G-M cryocooler and the bottom wall is heated at a constant heat flux.The numerical study is carried out by means of the Flunet software.Both the experimental and numerical simulation results show that the the natural convection of pressurized helium in the cylinder could reduce the temperature fluctuation effectively.The overall differences between numerical simulation and measurments are relatively small.

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