Designing an experimental device to estimate thermophysical conductive properties for superinsulating materials is generally difficult. The new methods proposed here are conceived in order to combine the advantages of previous well known methods. The main idea is to control the heat flux diffusion inside the sample by addition of a highly conductive metal support. A plane probe similar to the hot wire system is used both to apply a heat flux step and to measure the temperature response. Therefore, the transfer becomes quite 1D and steady, even if a model considering 3D geometry and transient state is necessary. The probe geometry is chosen in order to avoid convective heat losses effects.

The two dimensional model is built using integral transform technics coupled with the quadripole formalism. Asymptotic expansions and parameters sensitivity analysis give the first step of a three parameters estimation method and allow to define a validity criterium for each measurement. Experimental validation is shown with convenient appropriate size recommendations.

It is shown in this paper how easily the highly conductive metal support allow to keep a perfect control for the sample back side boundary condition. This fact is quite useful for studying fluid flows thermophysical properties. A method for couette flows thermal conductivity measurement is then implemented. A rotating highly conductive brass cylinder is used in order to create a shear stressed flow inside a teflon pool.

It is generally very difficult to solve the problem of transient heat transfer in couette flow. A 2D transient semi-analytical model is built using integral transform techniques coupled with the quadripole formalism, as well as a discretization approach. Since the three parameters estimation problem is ill-posed, a combination of two different experiments is necessary for estimating the fluid’s thermal conductivity, specific heat and viscosity. Validation is obtained with two kind of fluids with well-known properties.