ANALYSIS OF THE TEMPERATURE DISTRIBUTION IN A GUARDED HOT-PLATE APPARATUS FOR MEASURING THERMAL CONDUCTIVITY

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Abstract

The applications associated with a circular heat source on a circular and ring plate from a guarded hot-plate apparatus (GHPA) for measuring the thermal conductivity of insulating materials was investigated. The particular problem for which the solution is developed concerns the use of a heater embedded in a hot plate and guard ring to generate a heat flux within it respectively and it is shown that an elegant closed form analytical solution can be obtained for this problem. The Green's function formulation is used to compute the distribution of temperatures in the hot plate and the guard.

The analytic results of mathematical model were compared with measurements made on aluminum plates and it was found that them are in good agreement with experimental data with a standard deviation of 3%. The results can be used for obtaining the average temperature in the plates, which it will be the representative temperature. The solution permits to obtain the position of the main temperature, which will be the place where the thermocouples should be collocated on the plates of GHPA. The guarded hot-plate apparatus is shown in the Figure 1.



Figure 2. Guarded hot-plate apparatus for measuring thermal conductivity of insulating solid materials.