Mathematical analysis of Angstrom methods on semi-infinite body and its experimental application for determination of the thermophysical properties of material

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ABSTRACT
The presented mathematical analysis on semi-infinite body for determination of thermal diffusivity and thermal conductivity of material is based on a theory originally stated by Angstrom. It applies a periodic (sinusoidal) temperature oscillation on the front side of a semi-infinite body. The temperature distribution in sample from the front side are sinusodial until the end of sample is oscillations as well, but have difference amplitude and phase. Depending on distance and angular frequency from the initial boundary, amplitude and phase in the body will be presented in 3 dimensional graphic. Both the amplitude ratio and phase shift permit to calculate the thermal diffusivity of the material.
To determine thermal conductivity it can be calculated by adding a reference layer underneath the sample especially in semi-infinite body. The amplitude ratio and phase shift on both sides of reference layer indicate the heat flux entering the sample. Thus, if the thermal diffusivity and the thermal conductivity of reference layer are known, the thermal conductivity of sample can easily be obtained.
In this paper, the proposed experimental apparatus of Angstrom method for measuring thermal properties of material which use Peltier-Element to generate temperature oscillation will also described.