Analysis by Resonants Peaks of the Resonant Cavity Signal to Determine the Thermal Properties of Gases at Low Pressure

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In order to developing high efficiency thermal solar collector tubes, it is frequently to use vacuum insulation and therefore it is important to develop simple methodologies to study the behavior of the thermal properties of gases as a function of pressure. In this study, heat transfer in air, at different values of pressure, is studied using the Thermal Wave Resonant Cavity technique. The experimental configuration used, consisted of two parallel plates, one of them is heated by a modulated laser at a given frequency and the other is a pyroelectric sensor, which are separated by an air layer [1]. To regulate the pressure levels in the system, the cavity is connected to a vacuum pump. For each pressure value the photothermal phase and amplitude signals to a fixed cavity size were measured, varying the modulation frequency of the heater [2]. From the analysis of the resonance peaks of the real and imaginary parts of the photothermal signal, the values of thermal diffusivity of air are found [3]. Based on this approach, the value of the pressure, at which it is possible to determine the thermal transport properties of air, is established. The feasibility of using this technique for in-situ measurements for monitoring the quality of the vacuum in thermal solar evacuated tubes is discussed.

References

[1] Shen, J., Mandelis, A., & Ashe T. (1998). *International Journal Thermophysics, 19*(2).
[2] Matvienko, A., & Mandelis, A. (2005). *International Journal of Thermophysics,* 26(3).
[3] Shen, J., Mandelis, A., & Aloysius, B. (1996). *International Journal Thermophysics, 17*(6).