## Measurement of Thermophysical Properties and Development of ASTM Standard for Materials during Phase, Chemical, and Structural Transformations

Efim Litovsky<sup>C, S</sup> and Jacob Kleiman Thermophysical Properties Division, ITL Inc., Markham, ON, Canada elitovsky@itlinc.com

Evaluation of thermophysical properties during phase, chemical, and structural transformations (PCST) is required in various industrial fields dealing with chemical technology, materials sintering and heat treatment, heat transfer and drying of moist materials, ablation of protective materials in space apparatus, fire processes, etc. The main problems in investigation of thermal physical properties of materials during PCST can be formulated as follows:

- How to measure correctly apparent thermophysical properties during these processes.
- How to determine true thermal physical properties required for heat and mass transfer calculations during PCST.

In this paper we analyze different approaches which are applied in the testing of materials during PCST, including steady state methods, transient methods, using of inversed problems methodology. We describe our novel and modified conventional methods and techniques for measurement of thermal diffusivity, thermal conductivity, specific heat, thermal radiative properties during PCST. The main approach involves acquiring data during the monotonous heating or cooling of the sample which can be models of real technological processes. Examples of experimental data are presented in the temperature range from -50°C to 1800°C for testing of different thermophysical properties during PCHT for solid and powder materials, ceramics, metals, raw materials, porous beds, moist building insulation materials. Based on our investigations we give some recommendations for revision and development of the standard ASTM E2584-07 for testing of thermal conductivity of fire resistant materials which undergo significant reactions at monotonous heating/fire. Our methodology for determination of true thermal physical properties is based on excluding of latent heat effects and modeling of apparent thermal conductivity and heat transfer mechanisms. The problem of development of new generation of databases for apparent and true thermal physical properties during PCST is discussed.