Design of an Isolated and Controlled Precision System for Determination of Thermal and Moisture Transmission Properties

Jerry K. Keska and Russel R. Life

University of Louisiana at Lafayette

Abstract

In the analysis of thermal energy losses for a building, three components of thermal energy transfer need to be considered. These components are thermal energy conduction, convection, and radiation. The conduction component is influence by gradient of temperature in the exterior surfaces, the thermal conductivity, the effective area of exterior surface, and differences in air humidity between internal and external environment. The radiation components depend on a temperature difference, the geometry and or that of the building, and the thermal characteristics of the material used of the building. Thermal energy that is emitted to the sky from the exterior surface is considered to be a radiative component. Since radiation is a surface phenomenon, both the surface are and the surface property (emissivity) of the exterior wall material must be obtained for each exterior component of the building. After radiative heat energy losses of all components are found, they are summarized to receive the total thermal energy loss for radiation in the building.

This paper reports on design of an experimental system to study the effects of radiation through three ranges of the electromagnetic spectrum (specifically visible, infrared, and ultraviolet light) on a specified material in reference to a corresponding standard reference material. The ability to determine moisture content introduced through artificial means inside a contained system to maintain a test procedure is also part of this process. This system's parameters are determined by a variety of factors including size of test specimen and range of sources including light and moisture content. The goal of this project is to produce a reliable testing apparatus that corresponds to standard testing procedures for thermal transmission and moisture content properties of an unknown material and a standard reference material.

JERRY K. KESKA
Dr. Keska, a mechanical engineer, currently serves as an Associate Professor of Fluid Power and Mechanical Systems at the University of Louisiana at Lafayette. His research interests are in the areas of Microelectromechanical Systems (MEMS), fluid dynamics of complex heterogeneous mixtures (multiphase, slurries), tribology, microheatexchangers, computer aided-measurement systems and

instrumentation, electromagnetic sensors, turbulence and flow pattern phenomena in mixtures, and deterministic and random signal analysis including radiation process.

RUSSEL R. LIFE
Russel R. Life is a senior pursuing an associates degree in Industrial Technology and a bachelor's in Business. His interests lie in developing a foundation to successfully hone his technical abilities with marketing to promote products in industrial settings. He is a graduate of St. Thomas More and currently resides in Lafayette, Louisiana. He has prospects to relocate to Dallas, Texas, after completing his degree requirements in the summer of 2003.