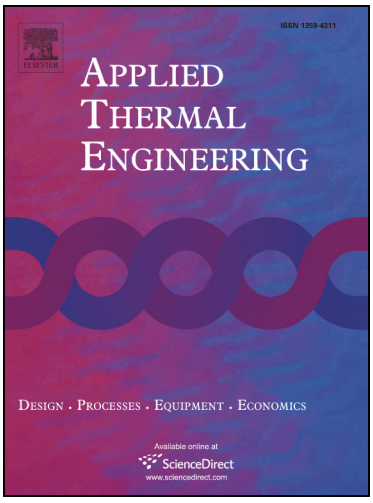

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AN INNOVATIVE COMPACT FACILITY FOR THE MEASUREMENT OF THE THERMAL PROPERTIES OF BUILDING MATERIALS: FIRST EXPERIMENTAL RESULTS

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Abstract

Thermal transmittances of opaque and transparent surfaces (U-values) is an influential parameter for the evaluation of the thermal losses through the building envelope. Usually, it is determined by measurements in climatic chamber using the hot-box or the thermo-flux meter methods, following the procedures described in international standards. Alternatively, U-value can be calculated analytically if the layers thermal resistances are known. To this purpose, in this paper the preliminary results obtained by an innovative facility for the calculation of the thermal properties of materials by means of the thermo-flux meter method, in prevalent mono-dimensional thermal flux conditions, are presented. Compared to traditional climatic chambers, the main facility features concern the reduced size, the transportability for in-situ measurements and hydronic circuits to supply radiant panels for the internal air temperature control, establishing a prevalent radiant exchange to attain uniform temperature on the specimen surfaces. Moreover, in order to establish a noticeable temperature difference across the tested sample, required to achieve reliable measurements by thermo-flux meter, a thermo-cryostat for the warm side and a small chiller for the cold one are employed. The supplied and absorbed thermal energies are measured by energy flowmeters. A comparison with the certified thermal conductivity provided by manufactures for some materials typically employed in the building sector has provided satisfactory correspondences.

keywords: *climatic chamber, radiant exchange, thermo-flux meter, U-value, energy flowmeters*

Nomenclature

A	Metered power supplying the warm sub-chamber [W]
B	Thermal losses through the facility walls [W]
C	Power transferred from the warm to the cold sub-chamber through the support frame [W]
D	Power crossing the material sample [W]
d	Thickness [cm]
E	Power transferred through the joints between sample and support frame [W]
F	Flanking thermal losses through the support frame [W]
h	Facility height [cm]
i	Homogeneous material
j	Heterogeneous material
k	Generic material
l	Facility length [cm]
R	Thermal resistance [m²°C/W]
T	Temperature [°C]
U	Thermal transmittance [W/m²°C]
w	Facility width [m]

Subscripts

av	average
c	cold
h	warm
SI	internal surface