

Accepted Manuscript

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PII: S0894-1777(17)30344-8

DOI: <https://doi.org/10.1016/j.expthermflusci.2017.10.038>

Reference: ETF 9262

To appear in: *Experimental Thermal and Fluid Science*

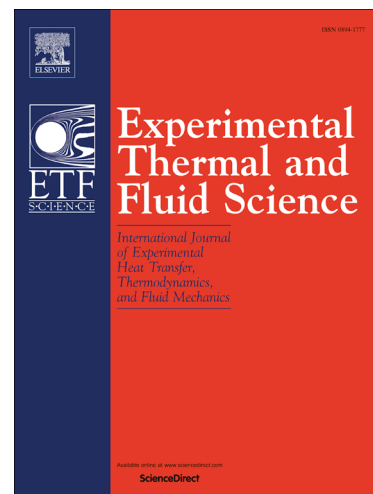
Received Date: 12 June 2017

Revised Date: 26 September 2017

Accepted Date: 29 October 2017

Please cite this article as: R. Hu, A. Ma, Y. Li, Transient Hot Strip Measures Thermal Conductivity of Organic Foam Thermal Insulation Materials, *Experimental Thermal and Fluid Science* (2017), doi: <https://doi.org/10.1016/j.expthermflusci.2017.10.038>

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Highlights

- THS method has good measurement accuracy for foam thermal insulation materials.
- Appropriate heating power for foam thermal insulation materials was proposed.
- Appropriate test temperature rise for foam thermal insulation materials is 6°C.
- The repeatability accuracy of THS method is better than THW method.

Abstract

Using low thermal conductivity building insulation materials is an effective way to reduce heat transfer through walls in a building therefore save building energy cost. A device based on the transient hot strip (THS) method was developed to measure thermal conductivities of organic foam thermal insulation materials. The influences of sample dimension and heating power on the calculation accuracy of the thermal conductivity were analyzed by numerical simulations and compared with experimental results. Moreover, the selection method of the appropriate heating power was proposed. The measurement results show that the device has good accuracy for measuring organic foam insulation materials and outperforms transient hot wire (THW) method.

Key words: transient hot-strip method, organic foam thermal insulation material, thermal conductivity, numerical simulation, measurement accuracy

Nomenclature

c_p	Specific heat capacity (J/kg K)	ε	Relative error of thermal conductivity
$erfc$	Complementary error function	λ	Thermal conductivity (W/m K)
h	Convective heat transfer coefficient (W/m ² K)	λ_0	Standard value of thermal conductivity (W/m K)
H	Sample height (mm)	ρ	Density (kg/m ³)
K	Correction coefficient	τ	Dimensionless time
L	Sample length (mm)	<i>Subscripts</i>	
P_0	Heating power per unit length (W/m)	1	Scale division of 0.00001 °C
q	Heat flux density (W/m ²)	2	Scale division of 0.1 °C
R^2	Linear fitting degree	ex	Experimental value
t	Time (s)	hw	Transient hot-wire method
T	Average temperature of the strip (°C)	id	Theoretical value
T_0	Initial temperature of the strip (°C)	m	Sample
ΔT	Temperature rise of the strip (°C)	max	Maximum value
W	Sample width (mm)	min	Minimum value
w_s	Half width of the strip (mm)	s	Hot strip
<i>Greek symbols</i>			
α	Thermal diffusivity (m ² /s)		
γ	Euler constant, =0.5772...		

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