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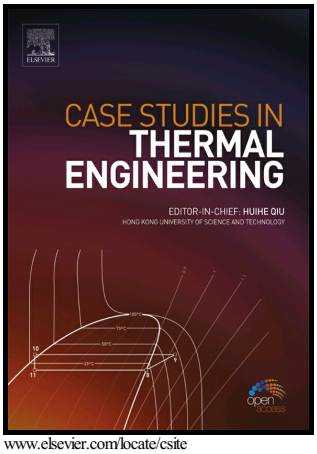

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Experimental study on upward flame spread characteristics of external thermal insulation material under the influence of porosity

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Abstract:

Upward flame spread characteristics over extruded polystyrene (XPS) foams with different porosities has been analyzed through experiments. In this paper, the average flame height and average maximum flame temperature first rise and then drop with increasing porosity, which is affected by the fuel and oxygen competition mechanisms. For P (the porosity of XPS samples) ≤35%, the positive effect of pores plays a dominant role; the average flame height and average maximum flame temperature increase with the increasing porosity. While the negative effect of pores plays a dominant role when P >35%, causing the average flame height and average maximum flame temperature decrease with the increasing porosity. Modeling and experiments were conducted to study the heat flux from flame. The value of radiation is obviously higher than convection through formula derivation and the experimental results have high similarity with the theoretical results.

Keywords: XPS; Porosity; Upward flame spread characteristics; Heat transfer.

Nomenclature

P	the porosity of XPS samples
h_p	the height of pore
w_p	the width of pore
n_p	the number of pores
h_s	the height of sample
w_s	the width of sample
A_p	the total area of the pores
A_s	the total area of sample
$\overline{T}$	the average maximum flame temperature
$\dot{q}''_{\mathrm{rad}}$	the radiation from flame
$\dot{q}''_{conv}$	the convection from flame
h	the convective coefficient
T_f	flame temperature
T_∞	ambient temperature
Ra_L	Raleigh number
β	the coefficient of expansion
g	gravitational acceleration