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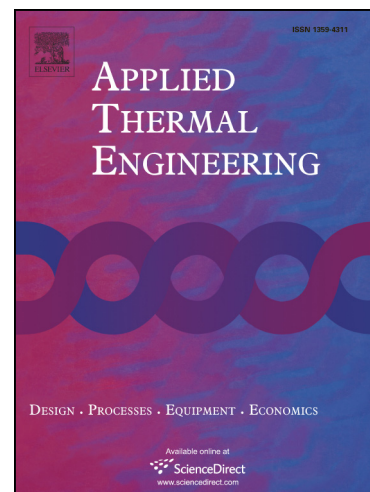
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Numerical study on the influences of heat and mass transfers on the pyrolysis of hydrocarbon fuel in mini-channel

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Abstract

There is a strong coupling relationship between pyrolysis and heat and mass transfer in convection heat transfer with chemical reaction. Therefore, a 2D numerical model was established to study the influences of radial heat and mass transfers on the pyrolysis of hydrocarbon fuel in cooling mini-channel. The characteristic times were defined through dimension analysis to quantitatively describe the times scales of radial heat and mass transfers. Numerical study results indicated that the flow field could be divided into three regions in radial direction according to influence mechanisms of heat and mass transfers on the pyrolysis. And the time scales of heat and mass transfers in the core flow were much smaller than that near wall, which caused the non-uniform distributions of reaction rate at cross section of channel. In addition, since pyrolysis suppressed the radial heat transfer by negative feedback way, so the conversion of hydrocarbon fuel near wall increase with heating rate, however, the conversion of hydrocarbon fuel in core flow decrease with heating rate, which caused the increase in the non-uniformity of conversion at the cross section.

Key Words: Numerical study, Pyrolysis, Heat and mass transfers, Hydrocarbon fuel.

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