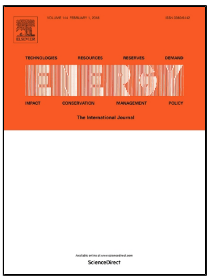
Accepted Manuscript



Experimental study of the hydraulic and thermal performances of nano-sized phase change emulsion in horizontal mini-tubes

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PII:	S0360-5442(18)30313-X
DOI:	10.1016/j.energy.2018.02.085
Reference:	EGY 12385
To appear in:	*Energy*
Received Date:	23 June 2017
Revised Date:	18 January 2018
Accepted Date:	17 February 2018

Please cite this article as: F. Ma, J. Chen, P. Zhang, Experimental study of the hydraulic and thermal performances of nano-sized phase change emulsion in horizontal mini-tubes, *Energy* (2018), doi: 10.1016/j.energy.2018.02.085

Experimental study of the hydraulic and thermal performances of nano-sized phase change emulsion in horizontal mini-tubes

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ABSTRACT

Phase change emulsion (PCE), which is formed through dispersing the phase change material (PCM) particles in the carrying fluid, has attracted many attentions as both the heat transfer fluid and energy storage medium. In the present study, nano-sized PCE is prepared by the D-phase method with n-hexadecane as the PCM. The mass fractions of the PCM are about 10.0 wt% and 20.0 wt% and the average particle size is about 290 nm. The thermo-fluidic performances of the nano-sized PCE in laminar flow are experimentally investigated in the mini-tubes with different inner diameters. The pressure drop of the PCE is compared with that of pure water and the variation of the friction factor with the Reynolds number is also studied. The local heat transfer coefficient (LHTC) of the PCE gradually reduces to the minimum value and then increases along the flow direction. The heat transfer performance of the PCE is improved with the increase of mass fraction of the PCM and flow velocity, and the enhancement is more significant in smaller tube. In addition, the heating power also shows the effect on the heat transfer performance of the PCE. The heat transfer correlation of the PCE in laminar flow is proposed and the deviation is within ±20.0% compared to the experimental results.

KEYWORDS: nano-sized phase change emulsion; laminar flow; pressure drop; heat transfer performance

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