Thermal Conductivity and Diffusivity of Solid/Liquid Phase Change N-Alkanes Determined by the Transient Hot Wire Technique

Catalina Velez, Mohamed Khayet [C] and Jose M. Ortiz de Zarate [S]
Department of Applied Physics I, Complutense University, Madrid, Spain
khayetm@fis.ucm.es

The transient multi-current hot wire technique is used to determine simultaneously the thermal conductivity (λ) and thermal diffusivity (a_T) of the solid/liquid phase change linear n-alkanes at atmospheric pressure in the range 258-348 K. These compounds are used in Phase Change Materials (PCM) for energy storage and recovery. The same set-up was used to measure λ and a_T of the liquid and the solid states at different electrical currents. Both odd- and even-numbered *n*-alkanes were considered (n-pentadecane, $C_{15}H_{32}$, n-hexadecane, $C_{16}H_{34}$, n-heptadecane, $C_{17}H_{36}$, n-octadecane, $C_{18}H_{38}$, n-nonadecane, $C_{19}H_{40}$ and n-eicosane, $C_{20}H_{42}$). The obtained results were compared with available literature data. In fact, no literature data were found for a_T of the n-alkanes considered in this study. The values obtained for the liquid phase cannot be in any reliable way extended to the solid phase. The discontinuity of λ near T_m was found to be higher for the *n*-alkane having the larger number of carbon atoms. The diffusivity a_T of C_{16}, C_{18} and C_{20} is larger in the solid phase than in the liquid phase. Low accuracy for both λ and a_T were obtained near (and below) the solid/liquid phase transition of the three *n*-alkanes, due to the latent heat of melting/crystallization that may affect the temperature of the wire.