818-824.
[14] Myers TG, Mitchell SL, Muchatibaya G, Myers MY. (2007). A cubic heat balance integral method for one dimensional melting of a finite thickness layer. Int. J. Heat Mass Transfer 50: 5305-5317. http://dx.doi.org/10.1016/j.ijheatmasstransfer.2007.06.014
[15] Gupta RS, Kumar D. (1981). Variable time step methods for one-dimensional Stefan problem with mixed boundary condition. Int. J. Heat Mass Transfer 24: 251-259. http://dx.doi.org/10.1016/0017-9310(81)90033-8
[16] Caldwell J, Chan CCH. (2000). Spherical solidification by the enthalpy method and the heat balance integral method. Applied Mathematical Modelling 24: 45-53. http://dx.doi.org/10.1016/S0307-904X(99)00031-1
[17] Trp A. (2005). An experimental and numerical investigation of heat transfer during technical grade paraffin melting and solidification in a shell and tube latent thermal energy storage unit. Int. J. of Solar Energy 79: 648-660. http://dx.doi.org/10.1016/j.solener.2005.03.006
[18] Dinu G. Thomas, Sajith Babu C, Sajith Gopi (2016). Performance analysis of a latent heat thermal energy storage system for solar energy applications. Inernational Conferrence on Emerging Trends in Engineering, Science and Technology 24: 469-476.
[19] Lamberg P, Lehtiniemi R, Henell AM. (2004). Numerical and experimental investigation of melting and freezing processes in phase change material storage. Int. J. of Thermal Sciences 43: 277-287. http://dx.doi.org/10.1016/j.ijthermalsci.2003.07.001
[20] Savovic S, Caldwell J. (2009). Numerical solution of Stefan problem with time-dependent boundary conditions by variable space grid method. Int. J. of Thermal Science 13: 165-174. http://dx.doi.org/10.2298/TSCI0904165S
[21] Goodman TR. (1958). The heat balance integral and its application to problems involving a change of phase. Trans. ASME Journal of Heat Transfer 80: 335-342.
[22] Srivastava M, Sinha MK. (2018). Mathematical analysis of phase change thermal energy storage system and effect of Stefan'S number on TESS performance. Advances in Modelling and Analysis A 55(4): 217-221. https://doi.org/10.18280.ama_a.550406
[23] Trancossi M, Pascoa J. (2018). A new dimensionless approach to general fluid dynamics problems that accounts both the first and the second law of thermodynamics. Mathematical Modelling and Engineering Problems 5(4): 331-340. https://doi.org/10.18280/mmep.050409

NOMENCLATURE

C	Heat capacity
k	constant, k=1,2 for cylinder & sphere respectively
K	thermal conductivity, W/m K
L	latent heat, J/Kg
Q_τ	non-dimensional total heat absorbed
R	radius, m
r_i	inner radius, m
S_t	Stefan number, $\frac{C\,(T_s - T_m)}{L}$
t	time, s
T_m	melting temperature, K
T_s	surface temperature, K

Greek symbols

α	thermal diffusivity, m^2/s
δ	Interface location
η	non-dimensional radial distance of phase front, δ/r_i
$\dot{\eta}$	time rate of non-dimensional radial distance of phase front, d η/d τ
ξ	non-dimensional radial distance within phase change, r/r_i
ρ	density, Kg/m^3
θ	non-dimensional temperature, $\frac{T-T_m}{T_s-T_m}$
τ	non-dimensional time, $\frac{\alpha\, t}{{r_i}^2}$