Abstract :

The aim of the present work is to develop an analytical solution to study volumetric heat generation effects during melting and solidification of nano-enhanced phase change material (PCM), encapsulated in horizontal cylindrical container of thermal energy storage. The mathematical model is based on pure conduction in PCM subject to convective heat transfer on outer surface of cylindrical capsule. The variables separation method and exponential integral function have been used to solve energy equation in both solid and liquid phases on transient regime. The model developed in this study was applied to previously reported experimental results and we found a good fit with our model. A parametric study was conducted to investigate the effects of volumetric heat generation on the phase change process during melting and solidification.