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A lump integral non-dimensional model is devised for the freezing and melting of the agitated bath material onto a plate additive having its heat capacity temperature-dependent. It indicates that this phenomenon is regulated by independent non-dimensional parameters – the property-ratio B of the additive-bath system, the conduction factor, C_{of} of the bath, the Stefan number S_t of the freezing bath material and the heat capacity coefficient, γ_{an} of additive and yields closed form solutions both for the frozen layer thickness ξ and the heat penetration thickness η. They are only functions of C_{of} and γ_{an} when the frozen layer thickness per unit Stefan number, ξ^* and time per unit property-ratio τ^* are taken. Further representation of ξ^* and η with respect to $(7+4\gamma_{an})C_{of}$, called ξ^*_c and η_c and τ^* with respect to $(7+4\gamma_{an})C_{of}^2$ known as τ^*_c enables to provide the time taken to develop the maximum frozen layer thickness, τ_{cmax}= 3/56 whereas this thickness, ξ^*_{cmax} = 3/56 the freezing and melting is completed in time τ^*_c = 3/14 and the melting of the frozen layer τ^*_{cme} = 9/56. When C_{of} approaches zero there is no formation of the frozen layer resulting in no time taken in the freezing and melting whereas $\gamma_{an} \to 0$ makes the freezing and melting phenomenon onto the uniform properties plate additive and reduces the present solutions to those of the literature validating the present model.

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