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Application of a Numerical Model of Multicomponent Alloys Solidification to Phase Change Materials Used in Thermal Energy Storage

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Regarding the growing use of fossil fuel by the energy sector and its impacts on the environment, the search for environmentally friendly energy management systems becomes fundamental. In this sense, Thermal Energy Storage (TES) with Phase Change Materials (PCMs) has become a promising technology to recover, store, and subsequently use the heat generated from renewable sources which in turn can provide industrial facilities more efficient, in addition to reducing CO? emissions. These materials can be found in pure, binary, and ternary forms, available as paraffin waxes, non-paraffinic organics, hydrated salts, and metals. Among these, metals stand out for generally presenting high thermal conductivity values. The proposed numerical model aims to provide auxiliary tools for the design of thermal reservoirs by considering the kinetics and controlling parameters of phase transformations related to the demand for power of charge and discharge. In this work, medium latent heat thermal energy storage LHTES materials ~900K are applied given new TEGs commercially available. For this purpose, a previously developed numerical model capable of simulating the solidification process of Al-Cu-Si alloys is carried out and the obtained numerical results are compared with experimental values of Al-6wt.%Cu-3wt.%Si alloy. Consequently, this model can be also applied to investigate different heat extraction scenarios, considering a wide range of both Biot and Fourier numbers.