Energy storage capsule model

The developed model is used to predict the melting and energy storage rates of spherical, cuboidal, cylindrical and triangular prism-shaped capsules keeping the PCM volume constant. It is observed that the time required for melting is reduced by 3, 10.39, 22.64, 11.68% for cubical, horizontal cylinder, horizontal prism and vertical prism ...

The effect of arrangement of the PCM capsules was also analyzed based on the model. Wu et al. [17] also presented a one-dimensional model to study the dynamic characteristics of solar heat storage system with PCM capsules. Paraffin was taken as the PCM and water was used as the HTF.

Packed-bed thermal energy storage (PBTES) systems utilizing phase change capsules have found extensive applications in thermal energy harvesting and management to alleviate energy supply-demand imbalances. Nevertheless, the sluggish thermal charging rate of phase change materials (PCMs) capsules remains a significant impediment to the rapid ...

This paper presents a novel concept of underground impermeable capsules formed by CO2 hydrates, which can be used to pressurize gas and/or fluids (water, air, and/or carbon dioxide) for energy storage. Such capsules can be used for Pumped-Hydro Compressed Carbon Dioxide Energy Storage; in which water is compressed against pressurized gas in the ...

Mao et al. [52] developed a two-dimensional concentric diffusion model to study the thermal performance of a PLTES system with three different PCMs The authors focused on the heat storage process of spherical PCM capsules and analyzed the influence of particle diameter, the height-to-diameter ratio of the tank, and porosity on the total stored ...

A numerical model is developed in order to study the melting characteristics of an encapsulated PCM based energy storage system subjected to the flow of HTF over a single or multiple capsules. Natural convection is considered inside the encapsulated PCM resulting in faster melting as compared to the conduction dominated phase change process.

In this paper, the characteristics of a thermal energy storage capsule, using PCM composed of a mixture of a sodium sulfate water solution and a gelled material to prevent the separation of the produced crystal, are discussed analytically and experimentally. ... On the basis of the analytical model mentioned in Section 3, ...

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