Long term thermal energy storage with stable supercooled sodium acetate trihydrate - DTU Orbit (08/11/2017)

Long term thermal energy storage with stable supercooled sodium acetate trihydrate

Utilizing stable supercooling of sodium acetate trihydrate makes it possible to store thermal energy partly loss free. This principle makes seasonal heat storage in compact systems possible. To keep high and stable energy content and cycling stability phase separation of the storage material must be avoided. This can be done by the use of the thickening agents carboxymethyl cellulose or xanthan rubber. Stable supercooling requires that the sodium acetate trihydrate is heated to a temperature somewhat higher than the melting temperature of 58 °C before it cools down. As the phase change material melts it expands and will cause a pressure built up in a closed chamber which might compromise stability of the supercooling. This can be avoided by having an air volume above the phase change material connected to an external pressure less expansion tank. Supercooled sodium acetate trihydrate at 20 °C stores up to 230 kJ/kg. TRNSYS simulations of a solar combi system including a storage with four heat storage modules of each 200 kg of sodium acetate trihydrate utilizing stable supercooling achieved a solar fraction of 80% for a low energy house in Danish climatic conditions.

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