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INORGANIC SALT HYDRATES AS PHASE CHANGE MATERIALS (PCM) FOR THERMAL ENERGY STORAGE IN SOLAR INSTALLATIONS

NIEORGANICZNE HYDRATY SOLI JAKO MATERIAŁY ZMIENNOFAZOWE (PCM) DO MAGAZYNOWANIA ENERGII CIEPLNEJ W INSTALACJACH SŁONECZNYCH

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Abstract

The authors present a general idea of using inorganic salt hydrates in solar installations. A key role in this selection is played by thermophysical parameters, so the authors review their test methods and in turn characterize them for the most promising salt hydrates. Next, the authors describe the advantages and disadvantages of inorganic salt hydrates and indicate possibilities for their improvement. The use of salt hydrate converters in PV installations significantly improves the efficiency of photovoltaic modules. We show that at least 18 salt hydrates are promising for solar applications with the best ones being Sodium Hydrogen Phosphate Dodecahydrate, Sodium Carbonate Decahydrate and Calcium Chloride Hexahydrate. The selection of a test method for determining the thermophysical parameters of salt hydrates should be individual depending on the research objective. Comparing the methods presented, we believe that it is the DSC and DTA methods that provide the most accurate and repeatable results.

Keywords: salt hydrates, phase change materials, thermal energy storage, latent heat storage

Streszczenie

Autorzy przedstawiają ogólną koncepcję wykorzystania nieorganicznych hydratów solnych w instalacjach solarnych. Kluczową rolę w tym doborze odgrywają parametry termofizyczne, dlatego autorzy dokonują przeglądu metod ich badania i kolejno charakteryzują je dla najbardziej obiecujących hydratów solnych i ich mieszanin. Następnie autorzy opisują zalety i wady nieorganicznych hydratów solnych oraz wskazują możliwości ich udoskonalenia. Zastosowanie konwerterów hydratów solnych w instalacjach PV znacząco poprawia sprawność modułów fotowoltaicznych. Wykazano, że co najmniej 18 hydratów soli i ich mieszanin jest obiecujących dla zastosowań solarnych ze względu na korzystne parametry termofizyczne, przy czym najlepsze z nich to dodekahydrat wodorofosforan sodu, dekahydrat węglanu sodu i heksadydrat chlorku wapnia. Z przeglądu literatury wynika, że wybór metody badawczej do określenia parametrów termofizycznych hydratów soli powinien być indywidualny w zależności od celu badań. Porównując przedstawione metody, stwierdzono, że to właśnie metody DSC i DTA dają najbardziej dokładne i powtarzalne wyniki.

Słowa kluczowe: hydraty soli, materiały zmiennofazowe, magazynowanie energii cieplnej, magazynowanie ciepła utajonego

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