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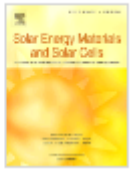

The effect of humidity, impurities and initial state on the corrosion of carbon and stainless steels in molten HitecXL salt for CSP application

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Highlights

- New insights into the corrosion process between some common constructive materials and nitrate molten salts are given.
- Strong effect of humidity, impurities and initial state of constructive material is investigated.
- Screening of appropriate constructive material for thermal energy storage unit at pilot CSP plant is performed.

Abstract

In this work, the compatibility of low-Cr carbon steel A516.Gr70 and stainless steels AISI 304 and AISI 316 with $NaNO_3$-KNO_3-$Ca(NO_3)_2$ (15–43–42 wt%) molten salt known as HitecXL was evaluated with the aim of determination the most suitable constructive material for a pilot thermocline thermal energy storage (TES) system of 20 MWh, which is under development for a commercial pilot concentrated solar power (CSP) plant of 1 MWe constructed at Green Energy Park in Ben Guerir in Morocco. It has been shown that the imperfection of initial state (roughness, exposure to atmosphere, surface defects) of carbon steel and humidity of the salt, inherent conditions of real applications, play a crucial role in the ability of the material to withstand corrosion attack of the molten HitecXL salt. The corrosion rates determined for studied materials allowed to select an appropriate low cost material with the highest corrosion resistance to be used for construction of the TES tank. New insights into the corrosion process of stainless and carbon steels by the nitrate salt have been made using a combination of different techniques, such as: SEM, EDX, XPS and XRD.

Keywords

Thermal energy storage; Compatibility; Concentrated solar power

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