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Green Energy 2021: Accelerated aging of absorber coatings for CSP receivers under real high solar flux

Reine Reoyo-Prats

PROMES, France

Abstract

Concentrated solar power plants are a promising solution to limit the dependency of some countries to fossil fuels or nuclear energy. These plants, located in sunny regions, are exposed to extreme climatic conditions. Moreover, they are supposed to work during 25 years. So, it is necessary to ensure the durability of the different components. In particular, high solar absorptance receivers are a key element in a CSP plant project, because they receive the concentrated sun arrays, and are submitted to important thermal shocks. In this presentation, different receiver materials are studied: four alloy substrates combined with four new absorber coatings, operable in solar towers with molten salts or steam as heat transfer fluids, and a classic Pyromark® paint considered as a reference. In order to test the durability of the coatings, 200 solar accelerated aging cycles were applied on the samples, using a concentrated solar facility (named SAAF). The cycles were defined so as to apply realistic high solar flux and temperature on the front side of the samples, with high cooling and heating rates reproducing the fast variation of solar irradiation due to cloudy weather and subsequent thermal shocks. The optical characteristics of the coatings were measured at the beginning and at regular intervals during the aging procedure. Different behaviors of the coatings were observed depending on the substrate, before any aging cycle. After this first aging campaign, some evolutions were observed on the solar absorptance or thermal emittance, depending on the substrate and the coating. Nevertheless, the degradations noticed are not significant enough to conclude about the durability of the coatings .