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Green Energy 2019: Accelerated aging of absorber coatings for CSP receivers under real high solar flux- Reine Reoyo Prats- French National Centre for Scientific Research

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Introduction

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, and 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.

Sun based force tower beneficiaries are presented to exceptionally thought sunlight based motion. Sunlight based radiation is retained at their surface and moved as warmth to the warmth move liquid. Their productivity is a key parameter of the worldwide force plant productivity. The materials utilized in sun based recipients need to withstand the solid corruption systems that happen in outrageous states of radiation and temperature. Their warm presentation by and large reductions until they have to be reestablished or supplanted. The maturing conduct of materials that are presented to high sun oriented motion isn't notable. It is important to consider the sturdiness of these materials by performing quickened maturing tests.

Safeguard tubes are the most well-known collector structure for business sun based force tower (SOLAR TWO, GEMASOLAR, IVANPAH). They are commonly made out of a metallic compound covered with an engrossing paint. Presented to the concentrated sun oriented motion, the liquid temperature typically arrives at 700 K. The sun oriented beneficiary model SOLHYCO situated in the Platforma Solar de Almeria (PSA), Spain, plans to arrive at higher working liquid temperatures of up to 1073 K. This recipient is made of Inconel 625 cylinders covered with Pyromark 2500 dark paint. The maturing of this two-layer material is examined.

We initially fabricated a numerical warm model so as to discover explicit warm and radiative conditions in which material maturing is upgraded. A Solar Accelerated Aging Facility (SAAF) is created and used to perform quickened maturing tests at high

Steady sunlight based irradiance for a few presentation times. Maturing is characterized by the development of trademark properties that have impact on the warm presentation of the material. The model permitted us to distinguish these properties as the sun based absorptance, the warm conductivity, and the warm contact obstruction between the covering and the metallic substrate. These properties should be observed during maturing tests as they describe the maturing condition of the material. A sun based optical fiber reflectometer is utilized to evaluate the sun based absorptance, and a motivation photothermal technique is utilized to evaluate the warm conductivity and the warm contact opposition of each sun based rewarded test.

Image:

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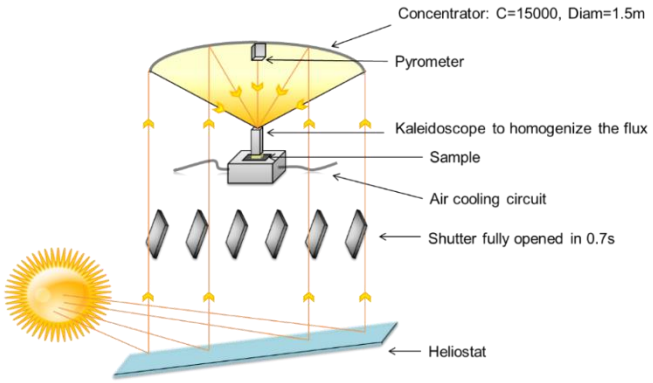

Keywords: thermal emittance, absorptance, gas emission, smart network technologies, integration.

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