

Thermal stability of a porous multilayer absorber for CSP applications

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Solar absorbers need to have high light absorption and excellent durability at elevated temperatures for concentrated solar power (CSP) applications. Nano Frontier Technology (NFT) developed stable thermal absorber coatings for CSP plants with high solar-weighted absorptance larger than 96%. A porous structured composed of black pigments and TiO₂ was created to enhance optical properties, while absorber coating was structured with multilayer (primer, base layer, absorption layer and top coating) to enhance durability. In this presentation, it is shown that the developed thermal absorbers coated on several substrate (stainless steel 253MA, 316L and Inconel 625) are stable at 850°C and 600 hours of isothermal aging, while keeping a solar-weighted absorptance value of 96%.

The spectral absorptance for the coated samples in pristine state and after aging at the 850°C for 10 and 100 hours in Figure 1 (a) for stainless steel 316L. The results are compared with reported measurements of spectral absorptance for Pyromark 2500 on the same substrate (Ref. in the figure table). The spectral-absorptance of the micro-textured coatings is significantly higher than that of Pyromark 2500, maintaining an excellent repeatability after aging, as evidenced by the narrow band of standard deviation shown in Figure 1 (a). Figure 1 (b) shows the solar-weighted absorptance after aging at the 850°C until 600 hours (SS316L) and 900 hours (Inconel625). The results indicate that the solar-weighted absorptance is kept larger than 96.4%. The morphology of the aged coatings was characterised under the SEM, which provided further evidence of degradation levels for NFT coatings and Pyromark, the former exhibiting less morphology changes than the latter.

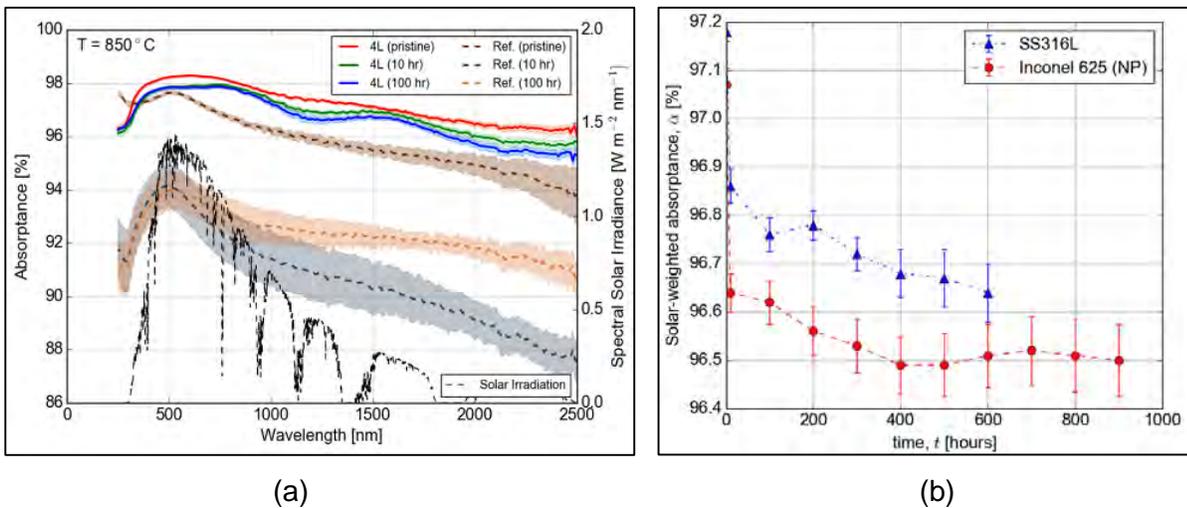


Figure 1. Spectral absorptane of coating on SS316L and comparison with Pyromark 2500 (a) and durability tests for SS316L and Inconel at 850°C (b).