Optimization of a Solar Selective Absorbers for Evacuated Flat Plate Collectors

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Solar energy plays a key role in the transition to clean, renewable energy resources. Evacuated flat plate solar collectors (EFPC) exploit the solar radiation to produce heat at mid- and high-temperatures, without concentration [1]. They use a flat absorber encapsulated in a hermetic vessel under high-vacuum insulation. Hence, the main mechanism of loss of EFPCs is the radiative loss from the selective solar absorber (SSA). For these types of collectors, thermal emittance affects performance more than solar absorptance, according to weighting factor (w) [2].

To improve the performances of these devices, the SSAs should be properly optimized maximizing the panel efficiency without giving a pre-determined weight to absorptance or thermal emittance. Numerical simulations are performed using transfer matrix method [3] with the refractive index of the materials measured with a phase modulated spectroscopic ellipsometer (UVISEL by Jobin Yvon Horiba) [4]. The optimized coating was obtained maximizing the panel efficiency for an operating temperature of 473 K, recording an improvement in performance of about 20% compared to a commercial absorber currently used in EFPC.

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