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Angular solar absorptance and thermal stability of W/WAlN/WAlON/Al_2O_3 based solar selective absorber coating

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The solar absorptance property of W/WAlN/WAlON/Al_2O_3-based coating, deposited by DC/RF magnetron sputtering on W coated stainless steel substrate was studied by measuring the reflectance spectra in the wavelength range of 250-2500 nm and more importantly by varying the incident angles from 8° to 68°.The effect of thermal annealing on the optical properties, microstructure and morphology of the solar selective absorber coating was also investigated. Annealing the coating at 350 °C for 250 h in air did not show any significant change in the spectral properties of the absorber coating indicating the excellent thermal stability of the coating. However, annealing for longer duration (>250 h) leads to a decrease in solar absorptance and a considerable increase in thermal emittance due to degradation of the coating (Figure 1). Atomic force microscope (AFM) image of heat treated coating has been shown in Figure 2.

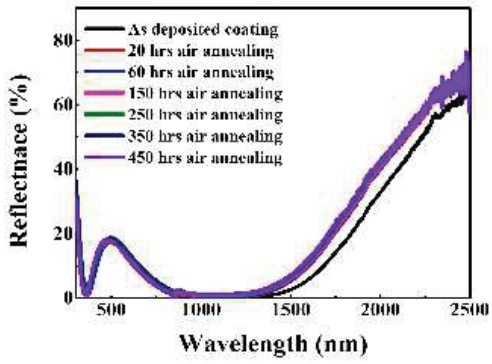

Figure 1: Reflectance spectra of as-deposited and heat treated coatings

The experimental studies on the degraded coating are discussed in reference to the interdiffusion between the layers with diffusion of tungsten towards the surface as well as oxidation of the tungsten layer.

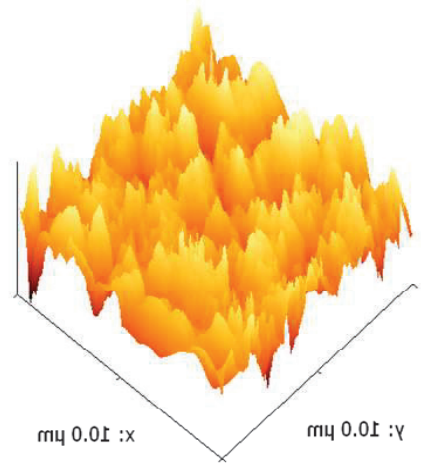

Figure 2: AFM image of heat treated coating

Taken together, the present study indicates the potential application of W/WAlN/WAlON/Al_2O_3-based selective coating in mid temperature photo thermal conversion systems.

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