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GROWTH, CHARACTERIZATION AND THERMAL STABILITY OF AlN/Ti/AlN/SiO₂ MULTILAYERED SELECTIVE SOLAR ABSORBER COATING FOR HIGH TEMPERATURE APPLICATIONS

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ABSTRACT- In this work, AlN/Ti/AlN/SiO₂ multilayered selective solar absorber coating (MSSAC) was deposited onto Fe₃O₄ modified stainless steel substrate using DC/RF magnetron sputtering. The substrate modification was done by simple annealing in air at 600 °C for 1h and achieved rough oxide layer of Fe₃O₄ on the surface of the substrate. The resulting samples were subjected to heat treatment at various temperatures in air for 2 h, and was characterized by X-ray diffraction, scanning electron microscopy, atomic force microscope, energy dispersive X-ray spectroscopy and UV-Vis-NIR spectrophotometer. The optical constants of the MSSAC was determined from the measured experimental reflectance data. The AlN/Ti/AlN/SiO₂ MSSAC was found to be thermally stable up to 500 °C in air with high solar absorptance of 93.04 in the solar spectrum range and low thermal emittance of 12.13 in the infrared range. The high absorptance is attributed to the columnar growth of the film as propped by SEM and AFM analysis and the antireflection layer of SiO₂. However, at 600 °C, the solar absorptance decreased to 91.78 from 93.04 and the thermal emittance rose to 19.03 from 12.13, which is attributed decrease in the surface roughness of the coatings.

Keywords: Sputtering, Annealing, Coating, Absorptance, Emittance.