Effect of substrate bias on microstructure evolution and infrared reflectivity of TiAl alloy thin films

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Abstract

Metallic thin films were widely used in solar selective absorbing tandem coatings because of good infrared reflectivity. In this work, TiAl alloy thin films were deposited on glass and p-(100) silicon substrate by a hybrid system combining arc ion plating and magnetron sputtering techniques. A negative bias ranging from 0 to -200V was applied on the substrate to investigate the effect of substrate bias on microstructure evolution and infrared reflectivity of the deposited TiAl thin films. Phase structure, surface morphology, microstructure and infrared reflectivity of the TiAl films were characterized using XRD, SEM, AFM, and FT-IR spectrophotometer. XRD patterns show that the TiAl films crystallize in bcc NaCl structure and the preferred orientation of the TiAl films change from (111) to (200) with increasing the substrate bias from 0 to -200V. From cross-sectional SEM observation, microstructure evolves from columnar to equiaxed one when the applied bias increases. Root mean roughness obtained from AFM results decreases when the applied substrate bias increases from 0V to -200V. The infrared reflectivity of the TiAl film prepared at -50V is the highest among the series of TiAl films, about 89%.

Keywords: TiAl thin film, substrate bias, microstructure evolution, infrared reflectivity

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