PT-P002

Characteristics of tungsten coated graphite using vacuum plasma spraying method

Hyeonmi Lim[1], Boram Kang[1], Hoseok Kim[1,2], and Bong Guen Hong[1,3]

[1]Department of Applied Plasma Engineering, Chonbuk National University, Jeonbuk, Republic of Korea, [2]High Enthalpy Plasma Center, Chonbuk National University, Jeonbuk, Republic of Korea, [3]Department of Quantum System Engineering, Chonbuk National University, Jeonbuk, Republic of Korea

Tungsten coatings on the graphite (CX-2320) were successfully deposited using the vacuum plasma spraying (VPS) method. An optimum coating procedure was developed and coating thicknesses of 409 ㎛ (without an interlayer) and 378 ㎛ (with an interlayer) were obtained with no cracks and no signs of delamination. The mechanical characteristics and microstructure of the tungsten coating layers were investigated using a Vickers hardness tester, FE-SEM, EDS, and XRD. The effect of a titanium interlayer on the properties of the tungsten coating was investigated. It was shown that the titanium interlayer prevented the diffusion of carbon to the tungsten layer, thereby suppressing the formation of tungsten carbide. Vickers hardness data yielded values that were 62.5 ~ 80.46% of those for bulk tungsten, indicating that tungsten coatings on graphite can be utilized as a plasma-facing material. High heat flux tests were performed by using thermal plasma with a maximum flux of 10 $MW/^2$. Vickers hardness after the heat flux test is performed to see a change in the mechanical properties. The formationof a tungsten carbide and the effect of the titanium interlayer for the diffusion barrier are investigated by using energy dispersion spectroscopy (EDS).

Keywords: tungsten coated graphite, VPS, Vacuum Plasma Spraying, tungsten, coating, graphite

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Study of microstructure of carbon-based materials in plasma wind tunnel testing

Bo-Ram Kang[1], Hyeon-Mi Lim[1], Phil-Yong Oh[2], and Bong Guen Hong[3]

[1]Department of Applied Plasma Engineering, Chonbuk National University, Jeonbuk, Republic of Korea, [2]High Enthalpy Plasma Center, Chonbuk National University, Jeonbuk, Republic of Korea, [3]Department of Quantum System Engineerting, Chonbuk National University, Jeonbuk, Republic of Korea

Carbon-based materials have been known as ablative material and have been used for thermal protection systems. Ablation is an erosive phenomenon that results in thermochemical and thermomechanical changes on materials. Ablation resistance is one of the key properties that determines performance and life-time of the thermal protection material under ablative conditions. In this study, ablation properties of graphite, 3-dimensional (C/C) composites (needle-punched type and rod type) were investigated byusing a plasma wind tunnel which produce a supersonic plasma flow from a segmented arc heater with the power level of 0.4 MW. The mass losses and surface roughness changes which contain main result of the ablation are measured. A morphological analysis ofthe carbon-based materials, before and after the ablation test, are performed through field emission scanning electron microscopy (FE-SEM) and non-contact 3D surface measuring system. Electronic balance and a portable surface roughness tester were used for evaluation of the recession and mass loss of the test samples.

Keywords: Carbon-based materials, thermal protection systems, ablation properties, surface roughness, morphological analysis