초청강연6

Corrosion Inhibition of the Wet-seal Area of Molten Carbonate Fuel Cell

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Some amount of highly oxygen-reactive yttrium was added in NiAl alloy to develop protective coating material for the wet-seal area of MCFC. Tests of immersion, electrochemical polarization and cyclic oxidation were done to estimate the adhesion and corrosion resistance of the oxide layer formed on the NiAl/Y alloys with various yttrium compositions up to 1.5at%. The yttrium added in NiAl alloy was precipitated at grain boundaries as NiAlY phase, which was oxidized to Y2O3 and Al2O3. According to the results of the immersion test, NiAl/Y alloy was found to be more resistant, forming a much more protective oxide layer than NiAl alloy. As the amount of yttrium in NiAl/Y alloy was increased, the corrosion rate was greatly reduced by restraining NiO formation and increasing Al amount in the oxide layer. The same results were obtained from anodic polarization test. The oxide layer was buckled for NiAl alloy by cooling in air after high temperature oxidation. This phenomenon was greatly reduced for NiAl/Y alloy when more than 0.7at% yttrium was added, which we believe was due to the formation of oxide pegs along the grain boundaries. Spallation of the oxide layer was also considerably reduced during cyclic oxidation, by increasing the amount of yttrium. It was found that NiAl/Y alloy with 0.7at% yttrium was the most suitable as a coating material for the wet-seal area, reducing internal oxidation and increasing adhesion and corrosion resistance of the oxide layer.