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용융탄산염내에서의 NiAl 합금의 내식성에 미치는 Lanthanum 의 첨가영향 (A study on the effects of Lanthanum on the corrosion of NiAl in Molten Carbonate)

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The corrosion problem of wet-seal area of the separator in molten carbonate has been known to be one of the major problems shortening the life of MCFC stack. To improve the corrosion resistance of wet-seal area of the separator, we added Lanthanum known as one of reactive elements into NiAl which had been known as a promising coating material on wet-seal area of the separator.

Lanthanum added was precipitated at grain boundary of NiAl as form of Ni-Al-La compound and reduced the grain size of NiAl to $1/5 \sim 1/8$ when La was added more than 1.0at% in arc-melting. The specimens were pre-oxidized and investigated of the composition and the morphology of the oxidized layers by XRD, SEM and EDS. The precipitated compound and the surface of grain were oxidized to La_2O_3 , Al_2O_3 and NiO. The oxidized layers became more thickened as La contents increased and at the grain boundary where La was precipitated, the oxidized layer was bulbed by the internal stress. Through cyclic oxidation test, the addition of La showed pegging effects at the grain boundary and slightly increased the adherency of oxidized layer. But immersion test showed its oxide layer was bursted out at grain boundary when corroded in molten carbonate for more than 100 hr due to the internal stress which occurred at oxidation. In 1000hr immersion test, the oxidized layers of NiAl/La alloys were spalled and internal oxidation was proceeded along the grain boundary to about $20 \sim 30 \mu\text{m}$.

Therefore though RE effects were shown by La addition, La didn't show the anticipated effects of improving corrosion resistance of NiAl on the corrosion in molten carbonate like other RE elements because oxidized La caused high internal stress when precipitated at grain boundary and, unlike cyclic oxidation, dissolution of NiO into molten carbonate could be possible to provide cracking sites. So other methods, not simple addition of La, should be developed to improve the corrosion resistance of NiAl in molten carbonate.