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Corrosion Behavior of AISI-316L Stainless Steel in Molten Carbonate Fuel Cell in Cathode Gas Environments

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The corrosion of the cell components is one of the hot issues in molten carbonate fuel cell(MCFC) development. To better understand the corrosion process in MCFC environment, electrochemical method as well as immersion test have been carried out. Corrosion behavior of AISI-type 316L stainless steel in an MCFC operating condition has been investigated with emphasis on the effect of sensitization. Polarization curve obtained by electrochemical potentiodynamic method and SEM observation on sample morphology after immersion in a carbonate melt were put together to understand the corrosion process. Th test was carried out in 62/38 lithium-potassium carbonate eutectic melt in the cathode gas environment. After the solution treatment at 1,200℃ for 4 hours followed by the sensitization treatment at 650℃ for predetermined time, the corrosion behavior of the sensitized sample was analyzed electrochemically by potentiodynamic method. The sensitized sample showed a typical behavior of active-passive transition. Increasing the time of sensitization treatment made the corrosion potential shift to the cathodic direction, and the passive film became more unstable showing high passive current, i. e., more susceptible to intergranular corrosion(IGC). From the morphological observation of samples immersed in a carbonate melt, the shift of corrosion process or mechanism from initial IGC due to sensitization to localized corrosion probably due to oxygen concentration profile, is confirmed. As a result, huge cavities developed from grooves along grain boundaries are formed after 200 hours of immersion in a carbonate melt.