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委託研究計畫研究報告

連接板金屬材料開發

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中文摘要

本研究主要目的為改善是固態氧化物燃料電池(Solid Oxide Fuel Cell)金屬連接板與固態氧化物的熱膨脹係數的差異，達到匹配的效果，並有良好的導電性質以提升連接器的品質，進而改善 SOFC 的使用效率以及耐久性。

實驗首先利用熱力學軟體 Thermal-Calc 繪出相關的熱力學相圖，了解不同成份下可能形成的相，並參考一些目前市場上已有的合金如 Crofer22 之成份，自行熔煉配製合金，量測其熱膨脹性質及導電度等性質，而初步期望得到較適合做為連接器原料的合金成份範圍。

研究結果發現 Fe-10Cr 及 Fe-16Cr 二成份的熱膨脹係數較小，與固態氧化鋯電解質的熱膨脹係數較接近，為燃料電池連接器的較有潛力的原料。

Abstract

This project is intended to reduce the thermal expansion differences between the metal interconnector of SOFC (Solid Oxide Fuel Cell) and solid oxidation. A higher efficiency and a more durable usage in SOFC can be achieved by matching similar coefficients in the electrolytes and having a better electrical conductivity

First, we calculate and draw phase diagram to predict the possible stable phases formed in the investigated alloys with the thermodynamics software Thermal-Calc. At the same time, some commercial alloys, such as Crofer22, is also referred to our own experimental alloy design. The alloys with various compositions are melted with an arc melter in NTU. The measurements of thermal expansion coefficients and electrical conductivities are carried out with TMA and ASM resistance instrument. The results indicate the Fe-10Cr alloy exhibits the smallest thermal expansion coefficient among the alloys, which is close to the coefficient of solid electrolyte ZrO_2. On the other hand, Fe-16Cr has a less electrical resistance in comparison with the Fe-10Cr alloy. Further investments will be needed to have the optimized composition of interconnector materials for the fuel cell in future researches next year.