Multilayered Ni-Zr Membranes for Hydrogen Separation

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Hydrogen separation membrane devices are attracting increasing interest as potential devices for the industrial production of hydrogen. In particular, metal membranes are promising because they can satisfy the requirements of a typical hydrogen-purification process. Palladium alloys are the only metals that satisfy all these requirements; however, palladium is prohibitively expensive. Therefore, the development of new alloy membranes by a minimal addition of Pd or the development of non-Pd-based membrane alloy becomes increasingly important.

In this study, polycrystalline Ni-Zr alloy membrane was prepared by a spark plasma sintering(SPS) method, and the characteristics of hydrogen permeation through the alloy membrane were examined

In order to get specimens, the developed NiZr powders were consolidated together by Spark plasma sintering. The ratio of Ni powders and Zr powders were chosen to be 64:36 weight ratio, respectively. The mixture of the Ni and Zr powders was filled on the upper and lower punches of 19.8 mm diameter graphite mold. During the consolidation of powders at SPS, heating rate was 2000C/min and the pressure was 10 kN. Sintering was done at different temperature range during 10 minutes under Ar-4%H_2 gas atmosphere. The sintering of multilayered materials is more difficult than sintering that of single-phase materials. This problem is caused by different sintering temperatures of the materials used in each layer. Different temperatures were applied in order to check the best sintering temperature of $Ni_{64}Zr_{36}$+$Ni_{36}Zr_{64}$ multilayered separator.

Although the measured hydrogen permeability of the fabricated multilayered membrane is slightly lower compared to the reported permeation values of Pd, however, a higher degree of hydrogen permeation was observed as compared to existing $Ni_{64}Zr_{36}$ single membrane.

Based on the obtained result, additional improvement of hydrogen permeation is expected through introduction of improved functional layers which have more elaborately controlled compositions.

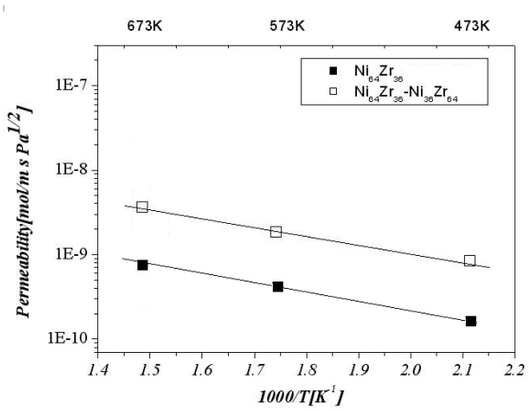

Fig. 1. Hydrogen permeability of the fabricated Ni-Zr multilayered membrane as a function of inverse temperature.

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