

Development of Palladium based alloys for hydrogen separation membranes

Fatih Piskin^{1,2} and Tayfur Öztürk^{2,3}

¹ Dept. of Metallurgical and Materials Engineering, Muğla Sıtkı Koçman University, Muğla,

² ENDAM, Center for Energy Storage Materials and Devices, Middle East Technical University, Ankara

³Dept. of Metallurgical and Materials Engineering, Middle East Technical University, Ankara

The need for hydrogen separation membranes has augmented over the years and it appears that it will continue augmenting further in coming decades. Instead of classical approach of addressing the need for hydrogen separation in centralized syngas facilities, it appears that there will be widespread need of relatively small scale installments either for feeding the hydrogen into storage system or taking the hydrogen from it wherever it is needed. The storage system in question could cover a number of alternatives, the most important is the network of natural gas pipeline which appears to be the emerging storage medium for hydrogen. It is thus timely to have a look at cost reduction strategies that can be employed in fabrication of separation membranes. The basis is commonly used separation membrane with composition of Pd-23%Ag. Two strategies may be employed; one to follow the basic strategy reflected by Pd- 23 %Ag, i.e. f.c.c. membranes that are ductile and can be processed metallurgically into

capillary tube or foil so that useful separation devices can be fabricated. Here there are two issues to be addressed; one how to reduce Pd content in order to make it cost effective, the second how to reduce the operating temperature which are traditionally targeted to syngas generation down to the much lower temperatures needed for the present or future needs. The second strategy would address the same but not via metallurgical processing of selected alloys but to direct fabrication of separation membranes via thin film deposition. In this paper, we investigate cost effective membranes in ternary alloys based on Pd-Ag-Ti, Pd-Ag-Ni, Pd-Ag-Mn and Pd-Nb-Ti using an efficient search methodology based on combinatorial material chemistry.



Fatih Pişkin is an Assoc. Professor in Department of Metallurgical and Materials Engineering at Muğla Sıtkı Koçman University. He received his BSc degree from Anadolu University in 2009, MSc and PhD degrees from Middle East Technical University in 2013 and 2018, respectively.

Corresponding author: Fatih Pişkin, e-mail: fatihpiskin@mu.edu.tr tel: +90 252 211 20 56