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Hydrogen gas Permeation through Pd-Zr internally oxidized alloys

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Abstract – The aim of this work is to study the hydrogen diffusivity and solubility properties using hydrogen gas permeation in Pd-Zr internally oxidized alloys. The interaction of hydrogen with microstructure was studied by temperature programmed desorption technique, TDS were used.

Due to the high hydrogen solubility and diffusivity in their matrix, Pd and Pd-based alloys are largely used as hydrogen filters and separators [1]. When internally oxidized, these alloys can have even higher hydrogen permeability, which is desirable for these applications.

In this work, the hydrogen diffusivity and solubility in Pd-Zr alloys were studied by using gas hydrogen permeation tests, in the conditions of solid solution and internally oxidized for 24h at 800°C and 1000°C. These tests were undertaken in the temperature range of 100-600°C. Furthermore, temperature programmed desorption (TPD) technique, to analyze the hydrogen-trap sites interactions, and X-ray diffraction, to identify the Zr-oxides inside the Pd matrix, were performed.

The hydrogen permeation results showed an expected lower diffusivity for the 800°C internally oxidized alloy, in comparison with the solid solution alloy, because of the presence of nanoparticles dispersed in the matrix, which act as effective trap sites for hydrogen diffusion.

The hydrogen binding energy with different microstructure was determined by TPD technique. It was found that the most pronounced binding energy was observed for oxidized Pd-Zr at 800°C for 24 h.

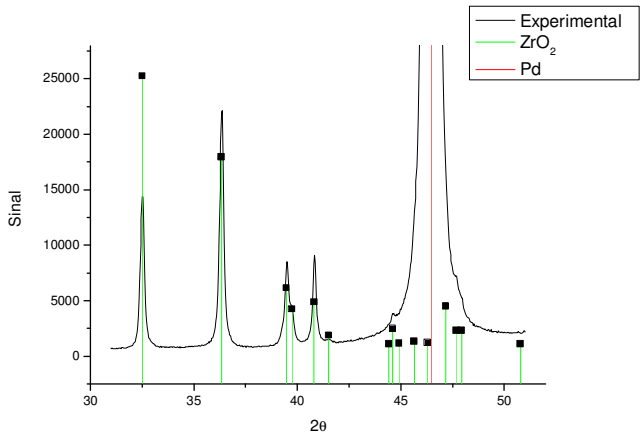

Figure: X-ray diffraction pattern for the $Pd_{0,95}Zr_{0,05}$ alloy internally oxidized at 1000°C.

[1] D. S. dos Santos, V. M. Azambuja, L. Pontonnier, S. Miraglia, D. Fruchart. Journal of Alloys and Compounds, Volumes 356-357, 11 August 2003, Pages 236-239