Project Report

Application No. 2018
Short title Effects of Zirconium and Polytetrafluoroethylene on the hydrogen sensing properties of Yttrium-Palladium based hydrogen indicator

Objectives: short, medium and long term (<250 words)

The objective of the measurements was to investigate why the addition of small amounts of Zr to an Y thin film resulted in a significant change in its hydrogen sorption properties, and the addition of sputtered PTFE on Pd-based thin film catalysts led to a profound increase in the hydrogenation and dehydrogenation kinetics. For this we needed to do in-situ Raman and Infrared (IR) measurements to detect possible changes in the chemical and/or structural properties of of Y , Zr , Pd , Pd-Au ally and polymers (PTFE, PMMA, FEP) before and after preparation, and how these properties changes as a function of an applied hydrogen pressure during hydrogenation, and oxygen during dehydrogenation.

Brief summary of work carried out:

Raman and Infrared (IR) signals of thin films of Y, Zr, Y-Zr alloys, Pd, Pd-Au alloys and polymers (PTFE, PMMA and FEP) were measured in the as-prepared state and in-situ in the presence of different concentrations of hydrogen. The samples were unloaded (dehydrogenated) in oxygen flow and the Raman and IR spectra acquired to check for possible changes in spectra. All measurement were done at room temperature using pure hydrogen and 5% H2/Ar mixture for hydrogenation, while dehydrogenation was done using a 20% O2/Ar gas mixture or just pumping air into the cell.

Main achievements intended for publication <250 words

See difficulties encountered.

Difficulties encountered <250 words

Major difficulties encountered was that the samples where not optimized for the particular Raman and and IR equipments at EMPA therefore the signals obtained was too weak (within the error limits of the equipments) to arrive at a reasonable conclusion. In particular the sample thickness was not high enough and the substrate (quartz) has a huge signal within the range of interest for our samples. We found out that the use of a different substrate than quartz for the thin film deposition could help to increase the signal to noise ratio.

Further comments: No