Abstract

The design of a volumetric measurement apparatus is studied by means of an uncertainty analysis to provide guidelines for optimum hydrogen sorption measurements. The reservoir volume should be as small as possible (i.e., 10 cc) to minimize the uncertainty. In addition, the sample mass loading has a profound effect on the uncertainty and the optimum loading is a function of the sample's intrinsic storage capacity. In general, the higher the sample mass loading the lower the uncertainty, regardless of any other parameter. In cases where the material to be tested is not available in gram quantities, the use of high accuracy pressure and temperature transducers significantly mitigates the uncertainty in the sample's hydrogen uptake. Above all, the thermal equilibration time is an important parameter for high accuracy measurements and needs to be taken into consideration at the start of the measurements. Based on a computational analysis, a 5 min wait time is required for achieving thermal equilibrium when the instrument enclosure temperature is different than the ambient temperature.

Citation

DE Demirocak, SS Srinivasan, MK Ram, DY Goswami & EK Stefanakos, Volumetric Hydrogen Sorption Measurements − Uncertainty error analysis and the importance of thermal equilibration time, International Journal of Hydrogen Energy, 2013, 38, 1469–77.