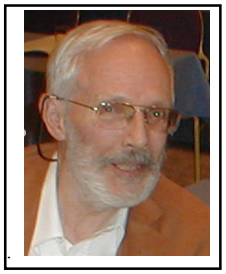
The enthalpy of formation of PdH as a function of H/Pd atom ratio and treatment



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Production of the LENR effect involves achieving a large concentration of D in the PdD lattice structure. A great deal of effort has been applied to understanding how this can be accomplished and the nature of the resulting structure. The bulk properties play a role in this process but are sensitive to the impurity content and treatment. The influence of the bulk properties on this process has not been fully explored.

This paper describes a new method to directly measure the bond energy between the PdH structure and the contained H atoms in real time as a function of H/Pd ratio from zero to the maximum H content using the electrolytic method and H_2SO_4+H_2O to react Pd with H. A unique and very accurate calorimeter (±5 mW) is used to measure power during the loading reaction. This method is applied to several types of Pd including commercial Pd sheet, extra pure Pd, and a zone refine single-crystal of Pd after each is subjected to several treatments. These treatments include repeated loading-deloading cycles, annealing at 900°C, and reduction in thickness. The bond energy is found to be sensitive to purity, treatment, and H/Pd ratio, with good agreement with published measurements being achieved after certain treatments. In addition, three methods to measure the average H/Pd ratio are described and compared. These methods use weight gain, orphaned oxygen, and recombiner temperature. A great deal of information about the reaction process can be obtained by combining these three methods because they are sensitive to different possible errors and behaviours.

Figure 1 compares the initial loading process and Fig. 2 compares the enthalpy of formation for the three different samples before the effect of treatment is explored. The bond between H and the lattice becomes repulsive (endothermic) as the upper H/Pd limit is approached.

The study has revealed unexpected behaviour and a new method to explore the environment in which LENR occurs.

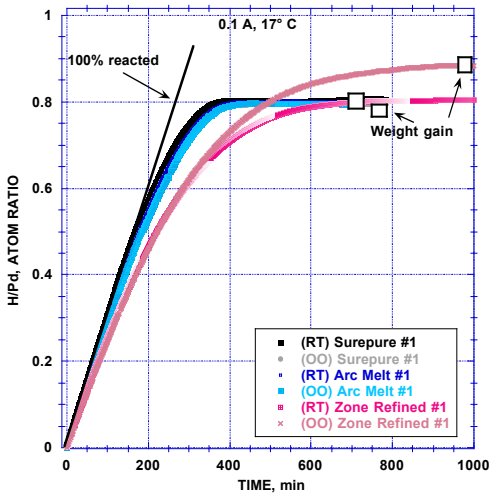

Fig. 1. Examples of loading behaviour by comparing the three different measurements of H/Pd ratio, where RT is recombiner temperature and OO is orphaned oxygen.

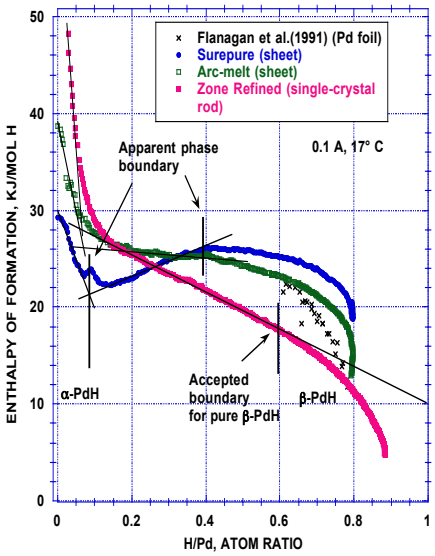

Fig. 2. Enthalpy of formation of the three types of Pd before treatment. Values are measured every minute.