

The Loading and Deloading Behavior of Palladium Hydride

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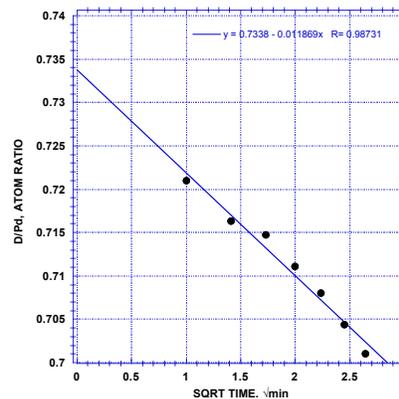


The ability to initiate LENR is believed related to being able to create PdD with a large D/Pd ratio. Various treatments have been applied to the surface to achieve this goal, with focus on loss reactions involving surface reactions being the primary cause limiting the deuterium content. This paper explores the effect of another loss mechanism involving surface penetrating cracks and flaws. These features allow hydrogen gas to leak out as bubbles (Fig. 1) at a rate related to a diffusion process that is not affected by applied current. This diffusion rate can be quantified by measuring the loss and relating it to the square root of time, an example of which is shown in Fig. 2. This relationship applies when loss occurs in the electrolyte after electrolytic current is stopped, in acetone, or in air. Extrapolation to zero time allows the final D/Pd ratio to be determined after current is stopped and the slope allows the contribution of this loss process to be determined while current is applied. Samples that load to a D/Pd ratio less than about 0.75 appear to show a loss rate by this process that is nearly equal to the rate at which D is applied by the current. Therefore, samples able to achieve a larger D/Pd ratio appear to have a loss rate determined by two mechanisms, loss from cracks and loss by surface reactions, i.e. the Tafel effect. Therefore, both mechanisms must be controlled to achieve a large D/Pd ratio.

FIGURE 1. Bubbles of H₂ from Pd in acetone



FIGURE 2. D/Pd vs square root time in air



The process of loading and deloading produces an unusual response by the shape and volume of the PdH structure. Repeating this process many times causes a plate of Pd to eventually assume the shape of a cube. In the process, the physical volume increases. Some samples are more susceptible to this process than others. Experience has shown that samples that do not readily change shape this way are more likely to host LENR.