

Ultr-high Density Cluster Enabled LENR

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Initial thin-film electrolytic LENR studies lead to the investigation of ultra-high density regions of Deuterium found in voids or dislocation loops in the films [1-2] Hydrogen “clusters” in these regions were estimated to have roughly 100–1000 atoms with superconducting properties below 70 °K as shown by SQUID measurements [3]. Subsequently, ways to increase the clusters per unit volume were studied, typically using multiple loading-deloaded techniques to build up voids and dislocation loops near film interfaces. Later, we extended these techniques to the creation of clusters in pores in nanoparticles employed in subsequent gas loading experiments [4]. The nanoparticles are formed from various alloys ranging from Pd-rich to Ni-rich zirconia based materials. Deuterium or hydrogen gas at pressures up to 100 psi is used, with the Pd-rich or Ni-rich nanoparticles, respectively. The LENRs are initiated by an initial temperature rise associated with gas absorption in the nanoparticles. Depending upon conditions, LENR heating then rises to 300–400 °K, followed by a slow drop off over about 4 hours under constant pressure conditions. This drop off is attributed to a decrease in H/D flux with static pressure, cf. the need for voltage pulses to maintain flux in the earlier thin film electrolysis work. Periodic pressure variations are employed to obtain controlled runs over much longer periods. Other methods for initiation of reactions and run time control of the reactions have been investigated with varying results. It is proposed that these observations explained in terms of flow-momentum exchange between diffusing gas ions and the clusters. Considerable attention has been devoted to the calorimetry used in studies of deuterium pressurized nanoparticles in recent experiments [5]. The relation between these studies and the earlier thin-film plus nanoparticle work will be discussed in detail.

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[2] G. H. Miley, “Product characteristics and energetics in thin-film electrolysis experiments,” 7th International Conference on Cold Fusion (ICCF-7), Vancouver, Canada, 1998.

[3] A. Lipson, B.J. Heuser, C. Castano, G. H. Miley, B. Lyakhov, A. Mitin, “Transport and Magnetic Anomalies below 70 °K in a Hydrogen-Cycled Pd Foil with a Thermally Grown Oxide,” *Phys. Rev. B.*, Vol. 72, p. 212507, 2005.

[4] G. H. Miley, et al., “Progress in Cluster Enabled LENR”, ICCF-21. Fort Collins, CO USA, 2018

[5] Benjamin Peecher, et al., “Calorimetry for Low Energy Nuclear Reactions (LENRs) in Hydrogen Pressurized Nanoparticles”, in this conference (ICCF-23)