Overview of Pd/D Co-deposition

#Pamela A. Mosier-Boss[1], Lawrence P. Forsley[1]
Frank E. Gordon[2]
[1] Global Energy Corporation, USA
SPAWAR Systems Center Pacific (retired)[2], USA
Email: pboss@san.rr.com

Pd/D co-deposition was first proposed by Stanislaw Szpak to eliminate long charging times and to create an ever-expanding electrode surface that assured the existence of non-steady state conditions and local high D loading in the lattice (D/Pd ratio ≥1). In the original protocol, working and counter electrodes were immersed in a solution of palladium chloride and lithium chloride in deuterated water. Palladium was then electrochemically reduced onto the surface of the working electrode in the presence of evolving deuterium gas. The resultant Pd deposit exhibited a uniform structure consisting of aggregates of spherical micro-globules, a large surface area, and an abundance of vacancies. Using this protocol, our group has reported that the heat source is the cathode [1, 2]. Infrared imaging of the cathode showed that heat generation occurs in the form of localized events that occur in close proximity to the contact surface. It was also observed that the higher the electrolyte temperature, the more frequent the events occurred in the cathode and that the events overlap to produce oscillating islands. We also reported on the production of tritium and energetic particles, including neutrons, as well as transmutation and the emission of γ-/X-rays [1, 2]. Furthermore, we explored the use of external electric and magnetic fields to stimulate/enhance these effects.

The Pd/D co-deposition experiment has offered great flexibility in experimental design. Different Pd plating solutions have been used by other researchers [2]. Different cell configurations (*e.g.*, parallel electrodes or concentric electrodes) have been used as well as working electrode surfaces (Au, Ag, Ni, Cu, or Pt) and geometries (wire, sheet, or screen). Closed and open system have also been used. Using variations of Pd/D co-deposition, researchers have reported on observing excess heat, gamma/X-ray emissions, transmutation, as well as the production of tritium and energetic particles.

The products observed by us and others indicate that several varieties of nuclear reactions are occurring in the system. These include primary and secondary fusion reactions to produce neutrons, protons, tritium, and ≥ 10 MeV protons and neutrons [3]. There is evidence of transmutation as shown by the production of Ag that can arise from either proton (≥ 10 MeV) or neutron capture by Pd [2]. The observation of long range alpha particles indicate the occurrence of ternary and quaternary fission of Pd [2] that is supported by the presence of such elements as Fe, Cr, Ni, and Al with a corresponding decrease in Pd [1].

[1] P.A. Mosier-Boss, J.Y. Dea, F.E. Gordon, L.P.G. Forsley, M.H. Miles, "Review of twenty years of LENR research using Pd/D co-deposition," J. Condensed Matter Nucl. Sci., vol. 4, pp. 173-187, 2011

[2] P.A. Mosier-Boss, L.P. Forsley, F.E. Gordon, D. Letts, D. Cravens, M.H. Miles, M. Swartz, J. Dash, F. Tanzella, P. Hagelstein, M. McKubre, J. Bao "Condensed matter nuclear reaction products observed in Pd/D co-deposition experiments," Curr. Sci., vol. 108, no.4, pp. 656-659, 2015.

[3] P.A. Mosier-Boss, L.P. Forsley, A.S. Roussetski, A.G. Lipson, F. Tanzella, E.I. Saunin, M. McKubre, B. Earle, D. Zhou, "Use of CR-39 detectors to determine the branching ratio in Pd/D co-deposition," Curr. Sci., vol. 108, no.4, pp. 585-588, 2015.