Synopsis of Refereed LENR Publications

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Scientists at the US Navy SPAWAR Systems Center-Pacific (SSC-Pacific), and its predecessors, in conjunction with JWK International Corporation, have had extraordinary success in publishing LENR papers in peer-reviewed journals. This success hasn't come easily and is due to several factors. One key reason was the courage of the SSC-Pacific upper management for twenty years in allowing scientists to conduct research and publish results in a controversial field. The few journal editors, who had the fortitude to consider our work, also contributed to this success. The reviewers also played a role in publishing our LENR-related papers. A multitude of reviewers, many outside the LENR field, had to put aside their biases and look objectively at our data. In turn, the reviewers' relentless concerns forced us to tenaciously address their issues.

As early as 1991, we began exploring nuclear effects, beginning with x-ray film and later, measuring tritium, then on to charged particles and neutrons using solid-state nuclear track detectors. We have also performed thermal imaging, and a colleague carried out calorimetry. He found that the Pd/D co-deposition surface exceeds the energy performance of bulk Pd cathodes. Subsequent papers examined elemental transmutation, effects of external fields, and measurements of fast neutron energy and their source. The majority of our work over the past decade has dealt with nuclear effects in the Pd/D system.

Through our research and these papers, we have sought to identify, characterize and elucidate the underlying LENR mechanisms. Ours has been a collaborative effort with colleagues around the globe. To date, the SSC-Pacific/JWK team has published twenty-nine refereed papers in eleven journals and two book chapters spanning 21 years. We have given more than twice as many conference talks and other presentations as well. This is a brief synopsis of the published publications.

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Journals

#	Journal	Volume	Year	Subject
1.	*J. Electroanal. Chem*.,	**302**	(1991)	co-dep introduced, heat, x-rays observed
2.	*J. Electroanal. Chem*.,	**309**	(1991)	modeling of deuterium transport in bulk cathodes
3.	*J. Electroanal. Chem*.,	**337**	(1992)	modeling and experimental deuterium transport obs.
4.	*J. Electroanal. Chem*.,	**365**	(1992)	modeling and exp D transport within Pd using XRF
5.	*J. Electroanal. Chem*.,	**373**	(1994)	Tritium modeling and production in co-dep
6.	*J. Electroanal. Chem*.,	**379**	(1994)	deuterium transport in co-dep
7.	*J. Electroanal. Chem*.,	**380**	(1995)	co-dep processes examined and discussed
8.	*Phys. Lett. A*.	**210**	(1996)	co-dep x-ray spectroscopy, lines identified
9.	*Phys. Lett. A*.	**221**	(1996)	thermal imaging and oscillating hot spots
10.	*Fusion Technology*,	**33**	(1998)	tritium production
11.	*Fusion Technology*,	**34**	(1998)	tritium production and co-dep morphology
12.	*Nuovo Cim. Soc. Ital. Fis. A*,	**112**	(1999)	thermal imaging, positive temp feedback
13.	*Fusion Technol*ogy,	**36**	(1999)	co-dep calorimetry
14.	*Thermochimica Acta*,	**410**	(2004)	co-dep calorimetry, excess heat exceeds bulk rate
15.	*J. Electroanal. Chem*.,	**580**	(2005)	E-field manipulation of co-dep morphology
16.	*Naturwissenschaften*,	**92**	(2005)	co-dep transmutation at ejecta sites
17.	*Naturwissenschaften*,	**94**	(2007)	co-dep charged particles using SSNTD
18.	*Eur. Phys. J. Appl. Phys.,*	**40**	(2007)	SSNTD controls and nuclear particle distribution
20.	*Naturwissenschaften*,	**96**	(2009)	co-dep triple-track, DT fusion observed
21.	*Eur. Phys. J. Appl. Phys.,*	**44**	(2008)	Response to Kowalski: co-dep nuclear tracks
22.	*Eur. Phys. J. Appl. Phys.,*	**46**	(2009)	co-dep nuclear particle specie and spectra
24.	*Eur. Phys. J. Appl. Phys.*	**51**	(2010)	comparison of co-dep and DT fusion tracks
25.	*J. Condensed Matter Nucl. Sci.*	**3**	(2010)	Response to Kowalski: co-dep nuclear species
26.	*J. Environ. Monitoring,*	**12**	(2010)	Response to Shanahan: LENR observations
27.	*J. Condensed Matter Nucl. Sci.*	**4**	(2011)	Review of 20 years of Pd:D co-dep research
28.	*Radiation Measurements*	**47**	(2012)	Comparison of optical and SEM DT track analysis
29.	*Detector Phys XIII, SPIE*	**8142**	(2011)	Optical and SEM analysis of DT & PdD tracks

Books

19. *Low Energy Nuclear Reactions Source Book*, American Chemical Society, (2008)
Co-dep model system, SSNTD controls, nuclear species and DT fusion neutrons

23. *Low Energy Nuclear Reactions Source Book II*, American Chemical Society, (2010)
Application of co-dep nuclear particles to RTG portable nuclear electric power

1. S. Szpak, P.A. Mosier-Boss, and J.J. Smith, "On the Behavior of Pd Deposited in the Presence of Evolving Deuterium," *J. Electroanal. Chem*., **302** (1991) 255-260

This was a preliminary note introducing the Pd/D co-deposition protocol as an alternative experimental approach to initiate LENR. Temperature measurements using thermocouples placed in the cathode and solution show that the cathode was hotter than the solution. This indicates that the observed heat is not due to Joule heating. A ten fold increase in tritium content in the solution was observed. Experiments were conducted with photographic film in close proximity of the cathode. After development, the film showed a grid pattern due to the Ni screen cathode and was attributable to the emission of soft X-rays.

2. S. Szpak, C.J. Gabriel, and R. J. Nowak, "Electrochemical Charging of Pd Rods," *J. Electroanal. Chem*., **309** (1991) 273-292

A model was developed to describe the electrochemical charging of palladium rods. This model coupled the interfacial processes with the transport of interstitials in the electrode interior. It was shown that boundary conditions arise from the solution of equations governing the elementary adsorption-desorption and adsorption-absorption steps as well as the symmetry of the electrode.

3. S. Szpak, P.A. Mosier-Boss, S.R. Scharber, and J.J. Smith, "Charging of the Pd/^{n}H System: Role of the Interphase," *J. Electroanal. Chem*., **337** (1992) 147-163.

Slow scan cyclic voltammetric studies of Au/Pd/^{n}H were conducted to examine the dynamics of transport of electrochemically deuterium/hydrogen across the electrode/electrolyte interphase. It was found that a coupled, two-layer model of the interphase describes the observed behavior as a function of scan rate and electrolyte composition. The effect of chemisorbing species, thiourea, and pH on the transport across the interphase was also investigated.

4. S. Szpak, P.A. Mosier-Boss, C.J. Gabriel, and J.J. Smith, "Absorption of Deuterium in Palladium Rods: Model vs. Experiment," *J. Electroanal. Chem*., **365** (1992) 275-286.

A model that incorporates variables such as electrochemical rate constants, bulk diffusion coefficient, and charging current has been developed. Such a model can be used to predict the overpotential, surface coverage, and bulk loading of the electrode during charging. The computed time dependence of the bulk loading has been compared with published experimental charging curves. Microscopic examination of a charging Pd cathode using Nomarski optics has shown that, even within a single grain, there are preferred sites of absorption. *In-situ* XRD measurements of the charging Pd cathode shows that deuterium preferentially enters the Pd lattice through the 111 sites. With additional charging, a broadening and a shift to lower 2θ angles was observed which suggested the presence of a supercharged layer.

5. S. Szpak, P.A. Mosier-Boss, R.D. Boss, and J.J. Smith, "Comments on the Analysis of Tritium Content in Electrochemical Cells," *J. Electroanal. Chem*., **373** (1994) 1-9.

The time dependence of tritium content of an open cell operating galvanostatically with intermittent sampling has been derived and is given by the following expression:

$$f(t) = f(0)\left(\frac{m(0) - r(i)t}{m(0)}\right)^{S-1} + \frac{q}{(S-1)r(i)} \bullet \left\{1 - \left[\frac{m(0) - r(i)t}{m(0)}\right]^{S-1}\right\}$$

where f is the tritium mass fraction, m is the mass of the electrolyte phase, r(i) denoted the rate of change associated with the cell current, q is the rate at which tritium is added/removed, and s is the isotopic separation factor. It was concluded that a complete mass balance between the liquid and gas phases was necessary in order to determine that tritium was produced in the Pd/D system.

6. S. Szpak, P.A. Mosier-Boss, and J.J. Smith, "Deuterium Uptake During Pd-D Codeposition," *J. Electroanal. Chem*., **379** (1994) 121-127.

Deuterium uptake during Pd-D co-deposition was examined using galvanostatic perturbation techniques. The resultant potential relaxation curves exhibit four distinct potential-time intervals where the relaxation process is controlled by the interaction between the transport of deuterium from inside the lattice to the surface to form adsorbed deuterium and the reduction of palladium from solution.

7. S. Szpak, P.A. Mosier-Boss, S.R. Scharber, and J.J. Smith, "Cyclic Voltammetry of Pd + D Codeposition," *J. Electroanal. Chem*., 3**80** (1995) 1-6.

Processes associated with the Pd + D alloy codeposition were examined by cyclic voltammetry. The dynamics of the interphase region are discussed.

8. S. Szpak, P.A. Mosier-Boss, and J.J. Smith, "On the Behavior of the Cathodically Polarized Pd/D System: Search for Emanating Radiation," *Phys. Lett. A*. **210** (1996) 382-390.

Pd/D co-deposition experiments were conducted inside lead caves while measuring gamma and X-rays, as a function of time, using a HPGe detector with an Al window and a Si(Li) detector with a Be window. The cathodically polarized Pd/D system was observed to emit X-rays with a broad energy distribution and with an occasional emergence of recognizable peaks attributable to the Pd K_α and Pt L lines. The emission of X-rays is sporadic and of limited duration.

9. S. Szpak and P.A. Mosier-Boss, "On the Behavior of the Cathodically Polarized Pd/D System: A Response to Vigier's Comments," *Phys. Lett. A*. **221** (1996) 141-143.

Preliminary results of thermal imaging of the Pd/D cathode prepared using the co-deposition technique are presented. Hot spots are observed that appear/disappear chaotically. With time these hot spots merge into larger islands that exhibit oscillatory behavior. SEM images of a Pd/D cathode that had melted during electrolysis are shown.

10. S. Szpak, P.A. Mosier-Boss, R.D. Boss, and J.J. Smith, "On the Behavior of the Pd/D System: Evidence for Tritium Production," *Fus. Technol*., **33** (1998) 38-51.

In these experiments, the D_2 and O_2 gases were recombined in a separate chamber. The tritium content in the liquid and gas phases were measured daily using a liquid scintillation. The measured data were analyzed using the mass balance expression that was derived earlier. It was observed that tritium production occurred in bursts and sporadically. During a burst, the rate of tritium production was estimated to be 10^3 to 10^4 atoms s^{-1}. Tritium produced during prolonged electrolysis was transported out of the electrode interior by two distinct paths. One path results in enrichment of tritium in both the electrolyte and gas phases. The second results in enhancement only in the gas phase.

11. S. Szpak and P.A. Mosier-Boss, "On the Release of ${}_1^nH$ from cathodically polarized Palladium Electrodes," *Fus. Technol*. **34** (1998) 273-278.

The release paths for tritium produced during electrochemical compression of deuterium in a Pd lattice were examined. The results indicate that tritium production requires high D/Pd atomic ratios. This requirement is met if there are no channels reaching the contact surface. The electrogenerated tritium is distributed among the voids and bulk material. Gas evolution promotes a continuous exchange between the ${}_1^nH$ atoms residing in the subsurface layer and with those in the adsorbed state. Atoms in the adsorbed state exchange with the molecules of the contacting electrolyte phase or gaseous phase, leading to two distinct transfer paths.

12. P.A. Mosier-Boss and S. Szpak, "The Pd/nH System: Transport Processes and Development of Thermal Instabilities*," Nuovo Cimento Soc. Ital. Fis. A*, **112** (1999) 577-587.

The surface temperature distribution of the cathode prepared by Pd/D co-deposition on a Ni screen was measured using an infrared camera. It was observed that, unlike joule heating, excess enthalpy generation occurs in the form of localized events in close proximity to the contact surface. It was also observed that, the higher the electrolyte temperature, the more frequent the events. In the limit, these events overlap to produce oscillating islands.

13. S. Szpak, P.A. Mosier-Boss, and M. H. Miles, "Calorimetry of the Pd + D Codeposition," *Fus. Technol*., **36** (1999) 234-241.

Calorimetric measurements indicate that the excess enthalpy generated in cells using cathodes prepared by the co-deposition process is, on average, higher than that produced in cells using solid Pd rods. Infrared imaging of the cathodes prepared by Pd/D co-deposition shows that the heat sources are highly localized. The steepness of the temperature gradients indicates that the heat sources are located in close proximity to the electrode-solution contact surface.

14. S. Szpak, P.A. Mosier-Boss, M. H. Miles, and M. Fleischmann, "Thermal Behavior of Polarized Pd/D Electrodes Prepared by Co-deposition," *Thermochimica Acta*, **410** (2004) 101-107.

The thermal behavior of Pd/D electrodes, prepared by the co-deposition technique, was examined using a Dewar-type electrochemical cell calorimeter. Results indicated that excess enthalpy is generated during and after the completion of the co-deposition process. The rates of excess enthalpy generated using the co-deposition technique were higher than those obtained using Pd wires or other forms of Pd electrodes. Positive feedback and heat-after-death effects were observed. The rates of excess power generation were found to increase with an increase in both cell current and cell temperature.

15. S. Szpak, P.A. Mosier-Boss, C. Young, and F.E. Gordon, "The Effect of an External Electric Field on Surface Morphology of Co-deposited Pd/D Films," *J. Electroanal. Chem*., **580** (2005) 284-290.

After plating out the Pd on a Au foil, the cell current was increased and an external electric field was applied across the cell. The experiment was terminated after 48 h. The cell was disassembled and the cathode was subjected to analysis using an SEM. In the absence of an external electric field, the Pd deposit exhibits a cauliflower structure. After exposure to an external electric field, significant changes in the morphology of the Pd/D deposit were observed. Fractal features were observed as well as dendritic growths, rods, wires, and craters. Considerable work is needed to account for the variety of shapes. The process of shape change is driven by energy transferred from the electrostatic field and directed by the field.

16. S. Szpak, P.A. Mosier-Boss, C. Young, and F.E. Gordon, "Evidence of Nuclear Reactions in the Pd Lattice," *Naturwissenschaften*, **92** (2005) 394-397.

When a cathode prepared by Pd/D co-deposition is subjected to an external electrostatic field, SEM analysis of the deposit shows discrete sites exhibiting molten-like features. Such features require substantial energy expenditure in order to form. EDX analysis of these features shows the presence of new elements (Al, Mg, Ca, Si, Zn,…) that could not be extracted from cell components.

17. S. Szpak, P.A. Mosier-Boss, and F.E. Gordon, "Further Evidence of Nuclear Reactions in the Pd/D Lattice: Emission of Charged Particles," *Naturwissenschaften*, **94** (2007) 511-514.

CR-39 is a solid state nuclear track detector that is used to detect energetic particles such as alphas, protons, tritons, and helium-3. Pd/D co-deposition was done, in the presence of an external electric or magnetic field, with the cathode in direct contact with a CR-39 detector. Tracks on the CR-39 detector were observed where the cathode was in contact with the plastic indicating that the source of the tracks is the cathode. The features of these tracks (optical contrast, shape, and bright spot in the center of the pit) are consistent with those observed for pits in CR-39 that are of a nuclear origin. The emission of the energetic particles is sporadic and occurs in bursts.

18. P.A. Mosier-Boss, S. Szpak, F.E. Gordon, and L.P.G. Forsley, "Use of CR-39 in Pd/D Co-deposition Experiments," *Eur. Phys. J. Appl. Phys.,* **40** (2007) 293-303.

A series of control experiments were conducted. It was shown that the tracks observed in CR-39 detectors subjected to Pd/D co-deposition were not due to radioactive contamination of the cell components. No tracks were observed when Cu was electrochemically plated on the surface of the CR-39 detectors. This indicates that the pits cannot be attributed to chemical attack of the surface of the CR-39 by either D_2, O_2, or Cl_2 present in the electrolyte. Nor can the pits be attributed to the metal dendrites piercing into the surface of the detectors. Additional experiments showed that LiCl is not essential for the production of pits and that the density of pits significantly decreases when light water is substituted for D_2O. Quantitative analysis using an automated scanner shows that there are three populations of tracks (0.1-0.5 μm, 0.9-4.0 μm, and 4.1-12 μm) and that the pits can be either perfectly circular or elliptical in shape.

19. P.A. Mosier-Boss, S. Szpak, F.E. Gordon, and L.P.G. Forsley, **"**Detection of Energetic Particles and Neutrons Emitted during Pd:D Co-deposition," *Low Energy Nuclear Reactions Source Book*, American Chemical Society , Chapter 14, (2008) 311-334.

Co-deposition procedures and control experiments specifically identified the conditions under which nuclear particles were observed, and ruled out chemical means of mimicking nuclear tracks. The nuclear tracks are quantitatively examined and are consistent with neutron knock-ons. Triple tracks are presented as evidence of $^{12}C(n,n')3\alpha$ indicative of DT fusion.

20. P.A. Mosier-Boss, S. Szpak, F.E. Gordon, and L.P.G. Forsley, **"**Triple Tracks in CR-39 as the Result of Pd/D Co-deposition: Evidence of Energetic Neutrons," *Naturwissenschaften*. **96** (2009) 135-142.

Triple tracks have been observed in CR-39 detectors used in Pd/D co-deposition experiments. Microscopic examination of the bottom of the triple track pit shows that the three lobes of the track are splitting apart from a center point. The presence of three α-particle tracks outgoing from a single point is diagnostic of the $^{12}C(n,n')3\alpha$ carbon break up reaction and is easily differentiated from other neutron interactions occurring within the CR-39 detector. The presence of triple tracks suggests that DT reactions that produce ≥9.6 MeV neutrons are occurring inside the Pd lattice.

21. P.A. Mosier-Boss, S. Szpak, F.E. Gordon, and L.P.G. Forsley, **"**"Use of CR-39 in Pd/D Co-deposition Experiments: A Response to Kowalski," *Eur. Phys. J. Appl. Phys.,* **44** (2008) 291-295.

Earlier we reported that the pits generated in CR-39 detectors during Pd/D co-deposition experiments are consistent with those observed for pits that are of a nuclear origin. Recently, that interpretation has been challenged. In this communication, additional experimental data and further analysis of our earlier results are provided that support our original conclusions.

22. P.A. Mosier-Boss, S. Szpak, F.E. Gordon, and L.P.G. Forsley, **"**Characterization of Tracks in CR-39 Detectors Obtained as a Result of Pd/D Co-deposition," *Eur. Phys. J. Appl. Phys.,* **46** (2009) 30901 p-12.

Spacer experiments and track modeling have been done to characterize the properties of the particles that generated the tracks in CR-39 detectors used in Pd/D co-deposition experiments. By placing a 6 μm thick Mylar film between the cathode and the detector, it was observed that ~90% of the energetic particles were blocked. Using LET curves, a 6 μm thick Mylar film cuts off < 0.45 MeV protons, < 0.55 MeV tritons, < 1.40 MeV ^{3}He, and < 1.45 MeV alphas. However, this is the energy of the particle when it reaches the CR-39 detector. It does not take into account the water layer the particle needs to traverse before it reaches the Mylar film. The Pd deposit exhibits a cauliflower like structure. Because of this structure, the particles need to traverse a water layer of varying thickness. Assuming water thicknesses varying between 0 and 10 μm, it is estimated that the majority of the particles formed as a result of Pd/D co-deposition are <0.45-0.97 MeV protons, < 0.55-1.25 MeV tritons, < 1.40-3.15 MeV ^{3}He, and < 1.45-3.30 MeV alphas. The estimated energies of the alpha particles are supported by computer modeling of the tracks using the TRACK_ETCH program developed by Nikezic and Yu. The energies of the particles formed as a result of Pd/D co-deposition are consistent with DD primary and secondary fusion reactions.

23. P.A. Mosier-Boss, F.E. Gordon, and L.P.G. Forsley, **"**Characterization of Energetic Particles Emitted During Pd/D Co-Deposition for Use in a Radioisotope Thermoelectric Generator (RTG)," *Low Energy Nuclear Reactions Source Book II*, American Chemical Society, (2010).

Use of the particles generated as the result of Pd/D co-deposition as a source to power RTGs was evaluated. It was observed that the production of these particles occurs in bursts and their generation is sporadic. Experiments conducted by placing a 6 μm thick Mylar film between the cathode and the CR-39 detector indicate that the majority of the particles have energies on the order of 1 MeV. This conclusion is supported by track modeling of the pits. Low energy radiation emission has been observed in Pd/D co-deposition. The cathodically polarized Pd/D system emits X-rays with a broad energy distribution (Bremsstrauhlung) with the occassional emergence of recognizable peaks (20 keV due to Pd Kα and 8-12 keV due to either Ni or Pt). Like the particle emissions, the emission of radiation is sporadic and of limited duration. On the back surface of the CR-39 detectors, tracks are observed. The size distribution and ellipticity of the tracks suggest that the tracks were caused by knock-ons due to neutrons. Triple tracks, diagnostic of the carbon break-up reaction, have been observed in the CR-39 detectors. The threshold energy of the neutron to initiate the carbon break-up reaction is 9.6 MeV. These results indicate that, for use to power an RTG, the Pd/D co-deposition operational parameters need to be optimized for particle generation. In particular, the flux of particles needs to be increased and the radiation/neutron emissions need to be minimized.

24. P.A. Mosier-Boss, J.Y. Dea, L.P.G. Forsley, M.S. Morey, J.R. Tinsley, J.P. Hurley, and F.E. Gordon, "Comparison of Pd/D Co-Deposition and DT Neutron Generated Triple Tracks Observed in CR-39 Detectors," *Eur. Phys. J. Appl. Phys.* **51** (2010) 20901

Solid state nuclear track detectors (SSNTDs), such as CR-39, have been used to detect energetic charged particles and neutrons. Of the neutron and charged particle interactions that can occur in CR-39, the one that is the most easily identifiable is the carbon breakup reaction. The observation of a triple track, which appears as three alpha particle tracks breaking away from a center point, is diagnostic of the $^{12}C(n,n')\ 3\alpha$ carbon breakup reaction. Such triple tracks have been observed in CR-39 detectors that have been used in Pd/D co-deposition experiments. In this communication, triple tracks in CR-39 detectors observed in Pd/D co-deposition experiments are compared with those generated upon exposure to a DT neutron source. It was found that both sets of tracks were indistinguishable. Both symmetric and asymmetric tracks were observed. Using linear energy transfer (LET) curves and track modeling, the energy of the neutron that created the triple track can be estimated.

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25. P.A. Mosier-Boss, L.P.G. Forsley, and F.E. Gordon, "Comments on Co-deposition Electrolysis Results: A Response to Kowalski," *J. Condensed Matter Nucl. Sci.* **3** (2010) 4–8

In 2009, it was reported that the tracks observed on the front surface of CR-39 detectors as a result of co-deposition were due to 0.45–0.97 MeV protons, 0.55–1.25 MeV tritons, 1.40–3.15 MeV ^{3}He, and/or 1.45–3.30 MeV alphas. Recently those conclusions have been challenged. In this communication, additional experimental data and further analysis of our earlier results are provided that support our original conclusions.

26. J. Marwan, M. C. H. McKubre, F. L. Tanzella, P. L. Hagelstein, M. H. Miles, M. R. Swartz, Edmund Storms, Y. Iwamura, P. A. Mosier-Boss and L. P. G. Forsley, "A new look at low-energy nuclear reaction (LENR) research: a response to Shanahan", *J. Environ. Monit.,* 2010, **12**, 1765-1770

In his criticisms of the review article on LENR by Krivit and Marwan, Shanahan has raised a number of issues in the areas of calorimetry, heat after death, elemental transmutation, energetic particle detection using CR-39, and the temporal correlation between heat and helium-4. These issues are addressed by the researchers who conducted the original work discussed in the Krivit and Marwan (K&M) review paper.

27. P. A. Mosier-Boss, JY. Dea, F. E. Gordon, L.P. Forsley, M.H. Miles, "Review of Twenty Years of LENR Research Using Pd/D Co-deposition", *J. Condensed Matter Nucl. Sci.* **4** (2011) 173–187.

In the Pd/D co-deposition process, working and counter electrodes are immersed in a solution of palladium chloride and lithium chloride in deuterated water. Palladium is then electrochemically reduced onto the surface of the working electrode in the presence of evolving deuterium gas. Electrodes prepared by Pd/D co-deposition exhibit highly expanded surfaces consisting of small spherical nodules. Because of this high surface area and electroplating in the presence of deuterium gas, the incubation time to achieve high D/Pd loadings necessary to initiate LENR is orders of magnitude less than required for bulk electrodes. Besides heat, the following nuclear emanations have been detected using Pd/D co-deposition: X-ray emission, tritium production, transmutation, and particle emission. Experimental details and results obtained over a twenty year period of research are discussed.

28. P.A. Mosier-Boss, L.P.G. Forsley, P. Carbonnelle, M.S. Morey, J.R. Tinsley, J. P. Hurley, F.E. Gordon, "Comparison of SEM and Optical Analysis of DT Neutron Tracks in CR-39 Detectors", *Radiation Measurements*, **47**, online doi:10.1016/j.radmeas.2011.10.004 (2012) pp 57-66.

A solid-state nuclear track detector, CR-39, was exposed to DT neutrons. After etching, the resultant tracks were analyzed using both optical and a scanning electron microscopy (SEM). Both complimentary methods of analyzing DT neutron tracks are discussed.

29. P.A. Mosier-Boss, L.P.G. Forsley, P. Carbonelle, M.S. Morey, J.R. Tinsley, J. P. Hurley, F.E. Gordon, "Comparison of SEM and Optical Analysis of DT Neutron Tracks in CR-39 Detectors", *Hard X-Ray, Gamma-Ray, and Neutron Detector Physics XIII*, edited by Franks, James, and Burger, **Proc. of SPIE Vol. 8142**, (2011) pp K1 – K8

CR-39 detectors were exposed to DT neutrons generated by a Thermo Fisher model A290 neutron generator. Afterwards, the etched tracks were examined both optically and by scanning electron microscopy (SEM). The purpose of the analysis was to compare the two techniques and to determine whether additional information on track geometry could be obtained by SEM analysis. The use of these techniques to examine triple tracks, diagnostic of ≥9.6 MeV neutrons, observed in CR-39 used in Pd/D co-deposition experiments is discussed.