Summary of ICCF14

The 14th International Conference on Cold Fusion

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Overview

Between August 10 and 15, the 14th International Conference on Condensed Matter Nuclear Science (ICCF14) took place in Washington, D.C. at the Hyatt Regency Hotel (on Capitol Hill). In many ways, this conference was an historic event. For the first time, experimental evidence was presented that shows conclusively that excess heat can be reproduced on demand. In one series of experiments (Arata and Zhang), the reported heat occurred using a device in which there was no electrical (or other) form of input power; the associated measurements of excess heat, which were performed by monitoring changes in temperature and pressure of gases above particular nm-scale palladium (Pd) powders, persisted for such long periods of time and involved such simple forms of measurement that it is virtually impossible to understand how the resulting effect could have occurred, except from room temperature nuclear reactions.

Photo by Marianne Macy

Prof. Yoshiaki Arata

Prior to the meeting, key results of these experiments were presented by Professor Yoshiaki Arata at Osaka University in Japan, during a press conference held on May 22. Other important findings included: 1) experiments in which the ratio of output to input heat has exceeded 2500% (output greater than input energy by a factor of approximately 25); 2) excess heat experiments in which the heat has been produced on-demand, in low power, high electrical impedance devices, using nearly pure heavy water; 3) the systematic use of two well-calibrated calorimeters and cathodes, involving forms of precision measurements of heat in a manner that has provided a way to study an effect (referred to as "heat after death"), in which excess heat continues in an electrolytic environment after electrical input current has been stopped; 4) detailed studies involving material response and structure in the presence of the electrolytic effects associated with excess heat, which have provided insight into the nature of excess heat generation, and 5) a series of studies in which higher energy particles were observed, including low level neutron emission in the kinds of co-deposition experiments that have been developed by Stanislaw Szpak and his colleagues from the Naval Space Warfare Systems Center.

There are 181 people listed as registered participants, but five of those people were unable to attend. The list of participants provides enough information to obtain an approximate picture of the distribution of the countries that were represented. This information helps to assess how people and institutions from different countries have decided to invest (or not invest) in potential forms of technology that might evolve out of the associated work. ICCF14 had the following distribution by country: 119 U.S., 17 Japan, 12 Italy, 8 Russia, 7 Israel, 5 Germany, 3 France, 2 Canada, 2 United Kingdom, and 1 each from China, Finland, India, Malaysia, Taiwan, and the Ukraine. Besides a large number of scientists, many participants were investors. According to the program, 61 oral presentations and 36 posters were scheduled to take place during the conference.

During the first two days, presentations were divided between new experimental results and reviews of experimental procedures. During this time, the conference organizers attempted to provide some of the more important information about the field. A crew from the CBS television program "60 Minutes" was filming during the first two days. It is worthwhile noting that the conference organizers attempted to change the manner in which results were presented by deliberately avoiding the terminology "cold fusion" and referring explicitly to work by Pons and Fleischmann as the Fleischmann-Pons Effect (FPE). The program itself began with the words "14th International Conference on Condensed Matter Nuclear Science," followed by the phrase, "14th International Conference on Cold Fusion."

The scheduled keynote speaker was Peter Nanos, the Associate Director of the Defense Threat Reduction Agency (DITRA, http://www.dtra.mil/). Apparently because of a scheduling conflict, an alternative speaker was engaged. Llewellyn King, journalist, former editor-in-chief and founder of *The Energy Daily* (the King Publishing Group's flagship newsletter), and now executive producer of the PBS television program, "White House Chronicle," gave the keynote address. The fact that such a well-known journalist would give the keynote address is consistent with the improved publicity associated with this ICCF conference. During the speech, Mr. King emphasized the past history of the energy situation. He recounted the problems of the initial oil shocks during the 1970s and the underlying ideas associated with using nuclear power and alternative fuel forms. He emphasized the importance of the role of government in altering the existing dynamic. He suggested that what was about to happen during ICCF14 is extremely important.

The general chairman of the conference, George Washington University Professor David J. Nagel, gave an introductory talk that provided an overview of what was to follow and also a context of the existing situation associated with cold fusion research. He pointed out that the study of the FPE started poorly almost 20 years ago. Scientific, technical, procedural and other problems burdened the field from the outset. He stated that at the present time, imperfect reproducibility, lack of a complete theory, inadequate funding, limited communications and problems with securing patents still challenge what is intrinsically an interdisciplinary and actually quite complex subject. He said that despite such difficulties, there has been remarkable scientific progress in studies of the FPE in the past two decades. Examination of data associated with the FPE convinces more and more people that the effect is now a legitimate field of science, and not a collection of mistakes.

Nagel emphasized that in the present climate of higher gasoline prices, it seems appropriate to re-examine the large disparity in funding between conventional fusion research and cold fusion research. In particular, he cited the fact that $10 billion will be spent for constructing and operating the major hot fusion facility in southern France, the International Thermonuclear Experimental Reactor (ITER). Given the past history of research in this area, it seems appropriate to consider increasing the amount of funding for alternative research in cold fusion—a very good cold fusion experiment could cost $1 million, an amount that is 10,000 times less than the amount projected for the ITER project. He suggested that even a minimal amount of investment (in comparison to the necessary investment that appears to be required in hot fusion) in cold fusion is called for, regardless of whether or not this research will eventually lead to a useful energy source.

As opposed to the early situation involving the FPE, where the associated experimental results were initially poorly understood, it is now known that low energy nuclear reactions—which appear to be the underlying phenomena that are responsible for the FPE—have been discovered in systems involving liquids, as in the initial electrolytic experiments, in gaseous environments, and in plasmas associated with high-voltage, low-power glow discharge experiments. Nagel suggested that evidence from particle beam experiments, involving more conventional collisions between charged particles in solids at lower energies (where detailed studies have now been conducted), appear to suggest that low energy nuclear reactions might be taking place in more conventional experiments in nuclear physics.

Although Nagel presented a guarded view about future prospects, he pointed out that some start-up and larger companies in the U.S. and elsewhere are now working on the science in anticipation of manufacturing power sources for sale. He said that production of energy without significant prompt radiation or residual radioactivity is a very strong motivator. It is possible that power sources varying from a few watts for portable electronics to 2 kW for home and mobile applications will result from the current research. Beyond the need for scientific understanding, current challenges include reproducibility, controllability, optimizations, scaling and reliability. It seems to most researchers dealing with the FPE that the field should be receiving significant support at a time of great concern about the large impact of rising energy costs.

Technical chairman Professor Michael Melich, from the Naval Postgraduate School, provided an overview of the material that was to be presented at the conference. He pointed out that the first two days of the conference would give attendees who had not been following research in Condensed Matter Nuclear Science (CMNS) an opportunity to understand the breadth and depth of work that has been done since 1989. In particular, reports of recent investigations would be presented first, with the more specialized work filling the final three days of the conference. For this conference, the organizers commissioned topical reviews and also invited groups of individuals from eight different countries to write the history of research associated with CMNS in their countries; these country histories will be written in the language of each country, and later translated and edited into a compilation in English. On August 13, a brief synopsis of country histories for China, France, India, Italy, Japan, and Russia were presented.

Although scheduling these kinds of talks was a departure from past practices at ICCF conferences, the idea of providing an historical overview of the subject and including reviews of important topics, at a time of heightened interest, was well-received.

On Wednesday afternoon (August 13), individuals from the conference visited a new part of the Smithsonian Air and Space Museum that is located outside of Washington, D.C., in northern Virginia. At the Wednesday evening banquet, Dr. Michael McKubre (on behalf of the International Society for Condensed Matter Nuclear Science) presented the Giuliano Preparata Medal to Dr. Irving Dardik, of Energetics, LLC, in recognition of his outstanding contributions in developing procedures for creating excess heat through the FPE. (See Dr. Dardik's acceptance speech on p. 8.)

Detailed Information

Including the opening session on Monday, there were a total of 16 sessions in which oral presentations were given. The opening session (discussed above), a Wednesday morning session devoted to country histories, and the final "Summary" session on Friday morning (where a number of individuals summarized what they felt were the most important results presented at the conference) were devoted to issues that were related to CMNS in more general terms. The remaining 13 sessions dealt more directly with specific aspects of the science. In addition, there were three poster sessions, which took place on Monday, Tuesday and Thursday afternoon, in which presenters talked to smaller groups of people in an informal manner about their work.

After lunch on the final day, a workshop took place that dealt with a different set of topics related to nuclear transmutation. This workshop, organized by Professor George Miley of the University of Illinois, was not included in the formal program of ICCF14, primarily because many of the topics still must be viewed as being speculative. (In particular, potentially new, but perhaps poorly-understood experiments related to nuclear transmutation include Mossbauer measurements that suggest a potential form of low energy nuclear reaction might take place in biological systems, for example.) At the end of this session, Professor Nagel provided an interesting observation about what was presented during the workshop: 15 years ago many of the ideas associated with the FPE were also viewed as being speculative, and, by implication, it is entirely possible that with time some of the ideas presented about transmutation during the workshop may become part of mainstream science.

The most important sessions took place on Monday and Tuesday morning. On Monday, Dr. Mitchell Swartz (JET Energy) and Dr. Shaul Lesin (Energetics Technologies) presented extremely important excess heat measurement results. On Tuesday morning there were three important sessions: "Gas and Fast Loading," "Honoring Yoshiaki Arata," and "Honoring Stanislaw Szpak." The most significant results were those presented during the session titled, "Honoring Yoshiaki Arata." Many conference attendees expressed interest in the talks that were scheduled as a result of preliminary reports that had appeared in the popular press in response to a press conference (referred to above) held on May 22, in which Professor Arata announced that he and Y.-C. Zhang had been able to create excess heat and helium-4, as a result of the FPE, on-demand, using a device that does not require any input power or energy once the experiment is pressurized. Prior to Arata's presentation, Talbot Chubb provided background material about Arata and an overview and interpretation of the work.

Figure 1 (from Dr. Chubb's presentation) shows a plot of a typical time history of temperature measurements during Professor Arata's experiments. In the figure, there are three sets of curves labeled A (associated with the two upper curves), C (the third highest curve), and D. In the plots associated with A and C, the temperature is shown, as a function of time, immediately at the boundary of (in the case of A) and inside (in A and C) a nm-scale size palladium (Pd) sample in the presence of an insulating oxide, ZrO_2, after a gas is loaded into it (by applying a pressure of ~100 atm). In the two curves associated with A, the Pd/ZrO_2 is loaded with D_2, and the temperature inside the sample (labeled T_{in}) is shown in the upper curve; immediately below this curve, a second curve is shown of the temperature (labeled T_s) at the boundary of the stainless steel flask (the subscript "s" in T_s is used as a short-hand for "stainless steel") that contains the gas and the sample. In the curve associated with C, the temperature (comparable to the highest curve associated with A, and labeled T_{in}) is plotted for a situation in which ordinary hydrogen, H_2, is loaded into the Pd/ZrO_2 sample. The third plot, labeled D, shows the time history of ambient temperature of the room where the experiment was conducted.

Talbot Chubb pointed out that both runs (involving D_2 in the two temperature plots associated with A, and H_2 in the plot associated with C) provide evidence of chemical heat (associated with the fact that the values of the temperature in and near the sample at the beginning of each run are greater than room temperature during the first nine hours of the experiment). He also pointed out, however, that after 10 hours during the H_2 run (plot C), the temperature inside (T_{in}) the sample had fallen to room temperature (plot D), while a similar asymptotic behavior (either in the temperature, T_{in}, inside the sample, or the temperature T_s, at the boundary of the stainless steel flask that holds the sample) does not take place during the D_2 run (shown by the behavior of the highest two curves associated with A). In particular, after 33 hours, the average value of the "reactor temperature"

$$T_{reactor} \sim \frac{T_s + T_{in}}{2}$$

asymptotically appears to approach the limit, $T_{reactor}$ ~(T_{room} + 1.6°C), where T_{room} is the value of the temperature of the room (associated with the plot labeled D). After approaching this asymptotic limit, $T_{reactor}$ remains constant for hundreds of hours.

The only plausible explanation for the cause of the observed temperatures is that it occurs as a result of a nuclear reaction. In particular, the temperature difference, $T_{reactor} - T_{room}$~1.6°C, is maintained without any external input power or input energy. The conditions associated with lack of input power and input energy which are responsible for this temperature difference are analogous to the comparable conditions that appear to be present in the temperature differences that occur in the phenomenon that has been called "heat after death" (in which excess heat persists in the absence of electrolytic input current during electrolysis experiments). However, there is an important, obvious physical difference in how the experiments are set-up: none of the complicating factors (and potential sources of error) associated with electrical currents, electricity, or electrolysis are involved. The effect is triggered entirely by subjecting nm scale powders of Pd/ZrO_2 to a pressurized (~100 atm) form of D_2 gas.

During the Monday morning session on excess heat, Mitchell Swartz presented results from a second set of extremely important experiments, demonstrating that it is now possible to create excess heat and power, with a good redundant set of measurements confirming the excess heat. These results are also important because the techniques that he employs for calibrating, analyzing, and understanding his heat measurements have provided important information for identifying new effects and forms of heat.

Swartz began his talk by describing a series of experiments performed with a low power electrolytic device that he refers to as a palladium Phusor™. These low to moderate power devices can create low energy nuclear reactions through a process he refers to as lattice assisted nuclear reaction (LANR). He presented data showing evolution of his work on a system which "began with wires and rods," used several metals and shapes over years and evolved to an open spiral palladium Phusor cathode. He and his co-worker Gayle

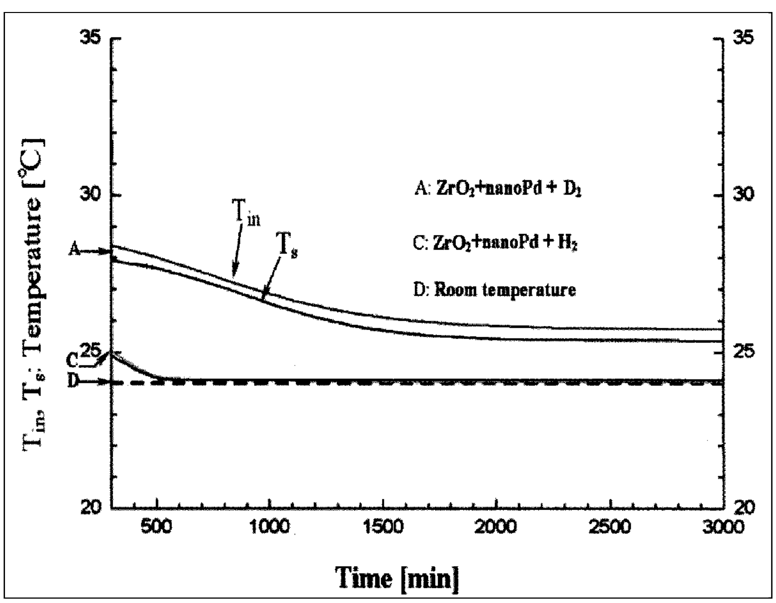

Figure 1. Typical time history of temperature measurements during Arata experiments.

Verner speculated that the "shape and orientation played a decisive role." In a separate poster, they reported that successful LANR devices are meta-materials creating intra-palladium deuteron flow which yields the excess power gain.

Swartz's best systems use particularly purer forms of heavy water, called "High Impedance Phusors." (This name is appropriate because these systems employ high voltages with relatively low currents.) He described results of other nickel, palladium, and titanium high electrical impedance ($Pd/D_2O/Pt$, $Pd/D_20/Au$, $Ni/[H_2O]_{1-x}[D_2O]x/Pt$) experiments, and other experiments, involving a techniques that he refers to as "codeposition." These codeposition experiments are different than a similar form of experiment developed by Dr. Szpak (described below) that we will refer to as experiments involving co-deposition.

In particular, both Swartz and Frank Gordon (a colleague of Szpak) showed that the "codeposition" and "co-deposition" experiments can be viewed as involving two groups with distinctly different sets of phenomena (resulting from either depositing the Pd and D on a substrate involving palladium or on different substrates, such as copper, gold, silver, or platinum that do not absorb D). Swartz used the deuterium and palladium flux equations and information about deuteron loading and Pd flux to maximize the D/Pd ratio.

Swartz publicly demonstrated a working model of one of these Phusor LANR devices during ICCF10. It produced ~230% excess energy at the multi-Watt level. During these experiments, he also demonstrated what he refers to as optimal operating point (OOP) operation. The concept involves a calibration procedure for identifying optimal loading conditions, through plots of output power as a function of input electrical power. Along with the OOP demonstration on Tuesday afternoon of the ICCF10 conference, the entire demonstration lasted five days.

During situations in which excess power is generated, a natural form of filtering seems to take place in these plots, in which sharp increases in power are observed as the input power is varied over a relatively small range. He first discovered this concept of OOP by his method of detailed data analysis. Together, these kinds of plots and OOPs helped Swartz to develop his Phusor devices.

At ICCF14, Swartz provided new, detailed data from measurements that were taken using these types of cells, and from newer cells that were developed later. Some were based on the first cell's design; others included data taken from connections made to paired motors.

At ICCF14, Swartz also showed results from complicated systems involving two cells. He referred to the heat measurement procedure employed in this new system as Dual Adjacent Calorimetry (DAC). Here, the two cells and calorimeters are placed almost adjacent to each other. The heat measurements were "dual-calibrated," using a procedure which involves monitoring the behavior of heat flow and calorimetric instruments simultaneously in the system. He showed results of several new types of Phusor devices using both the earlier and the newer DAC system. The devices included what he referred to as DAP-co-deposition Phusors and High Impedance Phusors.

Photo by Duy Tran

Mitchell Swartz

Swartz mentioned the "heat after death" (HAD) results he had obtained. He has continued to develop methods for monitoring HAD, based on data related to the thermal and electrical changes in both cells. New ways for triggering HAD appear to be possible by varying the input power (as a function of output power) so that the LANR devices approach their OOP.

It is worthwhile noting (as Swartz pointed out during his talk from ICCF9) that in nickel systems, Swartz has found that by adding increasing amounts of heavy water to a normal ("light") water cell, increased levels of excess heat can be obtained. Swartz is the only scientist, to my knowledge, who has investigated the possibility that these kinds of additions can enhance the excess heat effect, which seems to provide important information for more completely explaining the reactions. This is important because it potentially clarifies a possible origin of the excess heat results in the Ni/normal water systems. As opposed to the commonly held, intuitive idea that unusual nuclear reactions are occurring in this kind of system (as a result of the assumption that protium in the normal water is entirely responsible for the reaction), it is possible that the Ni substrate could filter or partially filter out protium, or an alternative process could be at work, in such a way that even the small (1 part in 6000) portion of deuterium (and heavy water) that is present in normal water could be playing an important role in the associated reactions.

Swartz employs important calibration measurements/procedures, including thermal ohmic controls, and thermal waveform reconstruction. He measures the background noise, showing it in his thermal power spectrograms. Since ICCF10 he has now supplemented these initial calibration procedures with additional controls, including paired Stirling engines and paired electricity production systems to demonstrate that usable energy is really being produced. His analysis of the heat measurements has generated important information about effects and forms of heat. In a separate talk, Swartz also reported on experiments which revealed non-thermal infrared radiation emissions from active palladium, nickel, and DAP-codeposition Phusors.

Swartz points out that OOP operation is important because it has helped to improve our understanding of how to obtain excess power and provided a way to develop a more standardized procedure for comparing excess power results in different samples. He has used the procedure as a valuable tool for directing his R&D. In particular, the procedure was invaluable in the analysis that led to the development of his Phusor LANR devices and to a better understanding of the onset of excess heat and photo-effects. It is plausible that during situations in which excess power is generated, a natural form of filtering is taking place in these graphs, in V*I space, in which large increases in output excess power are observed as the input power is varied over a relatively small range.

On Thursday morning, Swartz discussed a new topic that he refers to as the three region hypothesis (3RH), in which LANR reactions take place in three distinctive regions: 1) deep in a metallic lattice; 2) near the surface, and 3) in a variety of micro- and nano-meter size particles, that characterize electro-deposited and codeposited material in palladium and palladium alloys. He suggests that each location may have differing rates of (or no) excess heat, tritium, and helium production. Swartz expands on the 3RH in this issue of *IE*.

On Monday, Shaul Lesin (Energetics) also gave a very important talk titled, "Ultrasonically-Excited Electrolysis Experiments at Energetic Technologies." The talk was important because Lesin discussed experiments and experimental techniques that have demonstrated a highly successful (80% success rate) procedure for reproducing the excess heat effect and at magnitudes that are considerably larger than have been observed elsewhere. Key results that Lesin discussed involved modifying surfaces: 1) using short sequences of ultrasonically induced cavitation cycles (for cleaning the electrode surfaces), followed by low current density electrochemical loading, using Dardik's superwaves and 2) cleaning the electrode surfaces by etching them using glow discharge pulses that are constructed using superwaves, and then applying electrolytic currents that are also produced using superwave forms. Superwaves consist of highly non-linear (fractal) modulation.

After preparing the electrodes using ultrasound, as reported during ICCF13 by Tatiana Zilov on behalf of Emanuel Castagna (www.infinite-energy.com/images/pdfs/chubbiccf13.pdf), Energetics has found evidence of HAD. Lesin mentioned this fact, and reported information about three additional sets of experiments (#56, #64b, and #64a) involving electrode pretreatment with cavitation. In 64b, they found that the maximum Coefficient of Productivity (COP) Ratio (= Output Power/Input Power= (1+Excess) Power/Input Power) was greater than 15 (Percentage Excess Power/Input Power>1400%). In experiment 64a, they found an even higher maximal COP value, COP >~25 (Excess/Input %>2400%). In experiment 56, the ratio was 8 (Excess/Input%>700%). Excess heat in experiment 56 continued over the longest period of time (~300 hours), while excess heat in the other two experiments, 64b and 64a, respectively, was produced for periods of 17 and 80 hours. As a result, although the maximum COP that occurred in experiment 56 was only 8, the amount of excess energy, 3.1 MJ, that was produced during this experiment was comparable to the amount, 3.5 MJ, found in experiment 64b. In the experiment (64a), where the maximum amount of power was produced, the input power was less than 1 W, and the output power was greater than 20 W.

The other two Tuesday morning sessions, "Gas and Fast Loading" and "Honoring Stanislaw Szpak," were also important. These session names, as well as "Honoring Yoshiaka Arata," are somewhat unusual. The conference organizers were criticized prior to the event by *New Energy Times'* Steve Krivit (www.newenergytimes.com/news/2008/CMNS-LENR-Update-20080804.htm) for scheduling and titling sessions that explicitly honored Szpak and Arata. Although it is unusual to "honor" an individual by using the individual's name in the title of a particular scientific session, it is worthwhile noting that the contributions of Szpak and Arata have been extraordinary. On the other hand, the name "Gas and Fast Loading" is somewhat misleading. All three sessions, in principle, can be related to a more unifying theme associated with the potential role of smaller (micro- and nano-scale) structures in triggering the FPE. Micro- and nano-meter scale effects seem to be common in all of the associated experiments that were presented these three sessions. Further studies that focus on these kinds of structures and experiments should take place. However, the results presented in these sessions were sufficiently important that the somewhat unusual manner that they were introduced does not appear to have had a negative impact.

Professor Jean-Paul Biberian began the "Gas and Fast Loading" session with an overview of gas loading experiments that emphasized general features of the work. Biberian did not emphasize the importance of nanometer scale crystals in the associated effects. He did mention some of the work that he and Nicholas Armanet have done with these kinds of materials. During ICCF13 and during the "International Workshop on Anomalies in Deuterium/Hydrogen Loading in Metals," that was held last October in Catania, Sicily, he and Armanet provided a much more complete summary of their work. Professor Biberian's knowledge and wisdom are important, and it was wonderful to hear him speak.

Francesco Celani talked about related phenomena involving nm-scale materials, "Deuteron Electromigration in Thin Palladium Wires Coated with Nano-Particles: Evidence for Ultra-Fast Deuterium Loading and Anomalous, Large Thermal Effects." He mentioned that they have been working on a variant of the approach involving the nm-meter scale Pd/ZrO_2 crystals that Arata has developed. This new procedure has been conducted at the Instituto di Nazionale di Fisica Nucleare (INFN) in Frascati, Italy.

The particular experiments have involved the detection of anomalous thermal effects in long (50-150 cm) and thin (50 μm) Pd wires. The wires, which were coated with a mixture of salts of nm-scale materials, were fabricated from a deposition procedure that involves a thin film coating that forms from high temperature heating. The associated coating produces new forms of heat. The wires were put in a stainless steel chamber pressurized with deuterium gas that is similar to the configuration used by Arata. The chamber includes a calibration form of joule heating that involves a DC current (J=5000-50000 A/cm^2). The combined effect of high electric field and high temperature caused a large deuteron electromigration in the wires. After D_2 was introduced with a pressure of 5 bar, it was possible to obtain high loading very rapidly (within 6-12 s) for short periods of time, with a steady state average of 0.8 D-atoms per Pd atom, and anomalous thermal effects when large electro-migration currents were present. Apparently, the combination of using nanometer scale materials, gas-loading procedures, and wires with currents, involving high electric fields, and potential forms of electro-migration, appeared to be helpful in creating a reproducible form of excess heat.

In the final Tuesday morning session honoring Stanislaw Szpak, Dr. Frank Gordon and Dr. Pamela Mosier-Boss from the Naval Space Warfare Center, San Diego (NSWCSD), Larry Forsley, from JWK, Inc. (Annandale, VA), and Professor Melvin Miles (Dixie State College, formerly, La Verne College, La Verne, CA, and Naval Air Warfare Center, Weapons Division, China Lake, CA) provided an overview of some of the remarkable effects that have come out of pioneering ideas that Stanislaw Szpak has developed. This work involves an alternative way of creating the FPE, in which the effect is triggered electro-chemically in a way that differs significantly from what was initially done. In particular, in the co-depositional procedure suggested by Dr. Szpak, Pd and deuterium are deposited simultaneously on a substrate. As a consequence, high loading occurs in a very short period of time, and this, after the fact, has been identified as being important. In Issue 69 of *Infinite Energy*, I wrote about the initial reports by Mosier-Boss, Gordon, and Szpak, and the fact they had found what must be viewed as a "smoking gun" for convincing conventional nuclear physicists that the effect associated with the FPE involves a form of nuclear reaction: the possibility that high-energy particles can be created from a room temperature process involving electrolysis.

Mosier-Boss and Gordon first presented this material during a meeting of the National Defense Industrial Association at the end of July 2006. When I wrote about what they said, it was not at all clear that the effects were reproducible. Steve Krivit's New Energy Institute sponsored the work involving independent confirmation of these results. Within six months of the time I wrote my article, results from experiments that were conducted at four separate laboratories were reported at a meeting of the American Physical Society. They appeared to provide the first confirmation of the existence of the high-energy particles being emitted during the kinds of experiments that had been carried out by Mosier-Boss, Gordon and Szpak, based on the (electrolytic co-deposition) procedures that they had developed. In Issue 72, I reported preliminary information about results associated with these independent confirmations of this effect.

Szpak has advanced science in its truest sense through his persistence and idealism. Not only has he been creative, he has followed through with conviction, to make sure that what has happened, in spite of potential forms of hardship, has been recorded and presented openly and within the context of conventional science. Frank Gordon should also be commended for his foresight and creativity in recognizing the genius of Stan Szpak, and for encouraging and helping Pam and Stan to perform their research.

In fact, new, remarkable results continue to be reported as a direct consequence of the innovative technique developed by Szpak, Mosier-Boss, and Gordon. The ICCF14 session reviewed some of the material associated with their initial findings involving X-rays, tritium, and (more recently) high energy particles. They also included information about interesting morphological changes in the surfaces of their electrodes. In the three region hypothesis (3RH) paper by Mitchell Swartz that also appears in this issue of *Infinite Energy*, there are pictures that show some of these changes. It is worthwhile noting that because of advances associated with creating images at nm-scale dimension, it is possible to speculate about the relationship between these kinds of morphological changes and changes in the local environment that potentially can be relevant to the FPE and, in more general terms, to low energy nuclear reactions.

Larry Forsley provided important information about higher energy charged particles—possibly protons and alpha particles that can be related to tracks he has found in the surfaces of CR39 films, located closest to the electrodes used in the experiment and also in the same orientation relative to the electrodes, but outside the cells. Forsley spoke about potential forms of neutral particles (presumably neutrons), in tracks that he found at locations (on the back sides of the CR39 films, relative to the potential sources of high-energy particle emission associated with the electrodes). Steve Krivit has inspired an important dialogue between Larry Forsley and Andrei Lipson about subtleties with the analysis of tracks in CR39 films resulting from higher energy charged particles. A somewhat remarkable effect which Forsley observed in the tracks that were created in the co-deposition experiments involves the apparent creation of three alpha particles, resulting from collisions involving a higher energy particle with a carbon-12 nucleus. It is absolutely preposterous, given the facts associated with the data that Forsley used in this analysis, to assume that the associated nuclear effects are not related to the co-deposition process which clearly is responsible for creating them.

Melvin Miles also participated in the session. He discussed the fact that he had also reproduced the co-deposition effect, with excess power between 0.3 and 0.4 W. Earlier, on Monday, he also discussed subtleties associated with measuring excess power, using iso-peribolic calorimetry. In his experiments involving co-deposition, he used this form of calorimetry. The fact that he performed these kinds of measurements is important because precise measurements of excess power have not been made in co-deposition experiments. In particular, the fact that heat is present has been inferred in this work, using thermistor measurements of temperature and indirectly from infra-red images. (During ICCF10 in 2003, in particular, the NSWCSD team presented detailed images that are available online at http://lenr-canr.org/Collections/USNavy.htm). It is quite clear that the co-deposition procedure developed by Spzak and his colleagues Gordon and Mosier-Boss is extremely important. It has and will provide vital information about the nature of

Photo by Duy Tran

Larry Forsley, Frank Gordon and Pamela Mosier-Boss

Photo by Christy Frazier

Dennis Letts and Dennis Cravens

the FPE. Additional measurements involving the system are absolutely critical. These include detailed measurements of heat, with precise forms of calibration, which, in my opinion, should make use of the techniques developed by Mitchell Swartz. In addition, precision measurements of d-d, nuclear products, most importantly involving helium-4, are required. Understanding the relevance of excess heat and helium-4 in these experiments is essential since the associated reactions have been shown to be dominant in the other FPE experiments.

Information about a number of other important experiments was also reported. Vittorio Violante, from ENEA in Rome, Italy, presented an overview of the important work that has gone on in his institution, in collaboration with Energetics, SRI, and the Naval Research Laboratory. In their work, they have been focusing on the effects of changes in materials and the role of material structure in initiating the excess heat effects. In particular, although they have not been involved with using the kinds of nm-scale materials that Arata has used, they have used probes that are capable of investigating nm-scale effects. In examining the various kinds of materials that seem to be useful, they have found that high loading is necessary but not sufficient for creating excess power.

They have identified two kinds of materials that have distinctively different forms of behavior that create excess heat. They refer to these materials as type "A" and type "B". The type "A" materials created excess heat efficiently (with reproducible results occurring 75% of the time at SRI and 60% of the time at ENEA) but at reduced (20% Excess Power) levels. The type "B" materials also efficiently reproduced excess power but at significantly higher levels. In particular, in two instances, these materials had a coefficient of production (=excess power/input power) of 7 (or 700%) and 5 (500%). More detailed analyses indicate that the materials that appear to create greater amounts of excess power have structures that appear to have greater crystalline order in the surface regions. On Thursday, Francesca Sarto presented a talk, "Electrode Surface Morphology Characterization by Atomic Force Microscopy," which included a detailed discussion of an analysis of the power spectral density, associated with images of the surface of heat-producing and non-heat-producing electrodes. The power spectral density which is derived from a fourier transformation of images of the surface that are taken using Atomic Force Microscopy, provides a way to identify patterns in the variations of the surface morphology.

Photo by Duy Tran

Robert Smith, Jr.

Photo by Marianne Macy

Charles Beaudette

Photo by Christy Frazier

Takayoshi Nohmi

The associated decomposition shows that the improved performance associated with both type B and type A materials appears to be correlated with approximate ordering on the surface. Samples that do not give off excess heat effectively have random forms of orientation on the surface, while samples that give off excess heat have preferential forms of orientation. Although this analysis is preliminary now, the technique associated with the analysis seems to be sufficiently valuable that further work involving its use appears to be warranted. These kinds of studies of materials structure and materials characterization are unique and have not been carried out elsewhere. Information from them appears to be extremely important.

Other effects involving experiments associated with particle beams, *i.e.* work by J. Kasagi and his collaborators from Tohoku University, were presented later in the week. Also, preliminary work involving attempts to repeat experiments involving potential forms of transmutation, associated with work done at Mitsubishi Heavy Industries by Iwamura and co-workers, was discussed. There was also an interesting study by Edmund Storms involving the apparent creation of X-ray and soft gamma ray emission involving low amounts of electrical power.

David Nagel stated at the beginning of the conference that one of the factors that has impeded progress in the field is the fact there is no complete theory that describes what has taken place. This is a useful comment, but it appears to reflect confusion about the potential role of theory and, to a degree, details about what constitutes useful theory. An important point is that no serious effort appears to have been undertaken concerning this last, basic question. On Thursday, I raised this issue in more basic terms. I suggested that there have been considerable barriers to understanding what is taking place, based on preconceived notions about "existing theories" of fusion and variants of these ideas that have been suggested that might have bearing on the FPE. I suggested that in the end, the only "meaningful" theory that will be accepted must incorporate the established language of physics, which I suggested must involve conventional quantum mechanics. Confusion about quantum mechanics and its role in theoretical descriptions of the relevant physics has played an important role in the fact that at the present time an accepted, theoretical view about the phenomena does not exist. As the relevant science becomes more well defined, I am quite confident that greater theoretical input will occur, and that this will help to resolve many of the questions associated with confusion about the relevant science.

I only alluded to some important beam, transmutation and other results, which I will cover in more depth in Issue 82.

Preliminary planning has already begun for ICCF15, which will be held in Rome, Italy in September 2009, sponsored by ENEA and chaired by Vittorio Violante.

Dr. Irving Dardik's Preparata Medal Acceptance Speech at ICCF14

I am honored to be this year's recipient of the Preparata Prize and thank the Committee for this recognition. Back in 1991 I actually applied for a cold fusion patent based on SuperWaves. The United States patent office shelved it along with all the other applications that our community has submitted on cold fusion over the years. In 2001, one brave man, by the name of Professor Herman Branover, stepped forward and listened to my predictions that SuperWaves would make a difference in low energy nuclear reaction results. Next in, was Ehud Greenspan who stated that even if there was a 1% chance that I was right, he would listen. After hearing me out, he upped that percentage to 50% and joined Dr. Branover, Alison Godfrey and me in a meeting with Sidney Kimmel. In a bold, daring move, Sidney Kimmel committed his personal resources to funding a SuperWaves laboratory in Israel whose mission was to use SuperWaves, in yet to be discovered approaches to produce usable energy.

I am grateful to Alison Godfrey for her extraordinary leadership in building Energetics Technologies into what it is today. To Shaul Lesin for taking the lead in establishing Energetics in Israel and hiring a team of brilliant scientists in 2001—now this is 10 years—long years after my patent application was filed. Their work is impeccable and has justified Sidney Kimmel's participation. They have surpassed all expectations of what could be accomplished in a few short years using the SuperWaves.

By 2003, we presented some of our early results at ICCF10 and had the honor of drawing the attention of Mike McKubre. Mike's scientific sophistication and leadership in the DARPA replication projects with SRI, ENEA and NRL has been invaluable. I also want to thank Vittorio Violante of ENEA and the extraordinary team at the NRL under the leadership of Graham Hubler, for their outstanding contributions.

We should all acknowledge Dave Nagel and Mike Melich for organizing an extraordinary conference here, bringing in new faces and presenting the field in a cohesive and well developed way.

As Llewellyn King pointed out in his Keynote Address here, we are coming off of a summer of skyrocketing energy costs. It is only August, and many in this country and around the world are already in fear; wondering how they will afford to heat their homes this coming winter.

With all this talk of possible alternatives to the finite fossil fuel reserves, our community, our community, here, is not even part of the public dialogue. That, ladies and gentlemen, troubles me, because history teaches us that the driving forces behind the great ages of advancement, were not only people's needs and hopes and dreams—but also our innate hunger for knowledge. Yet in the midst of this traumatic awakening to our disastrous energy crisis, our research is missing from the radar of scientific and public debate. Yet, even though our community operates virtually in the shadows of science, we are under attack and have been so for nearly two decades. But as we expend positive and negative energy to protect ourselves—struggle financially for the survival of our research—we remain at the core, strong and resolute, because this is a community of courageous people, committed against all odds.

The stakes are easily articulated. The survival of civilization is dependant upon finding a safe, sustainable and readily accessible solution to the energy crisis. It is our job to remain focused on our goals and not take on a victim's mentality, nor get caught up in the tempting web of infighting. This quiet revolution is yielding results that are more and more reproducible. We are on the verge of developing a technology that promises to rescue our future. And it is the people in this room who are going to save the world.

But the revolution is now too quiet for our times. While they say we stand on the shoulders of giants, as Newton said, history is ripe with pivotal moments when the greatest minds of an age, doubted alternative thought, based on an assertion that all there was to be known was known. Make no mistake about it, we live in such a time.

The greatest advances in all of science have always come from ideas that were vilified. From Galileo, to Columbus, to Semmelweis whose career was destroyed for having the audacity to suggest that physicians should wash their hands before delivering a baby. We can proudly add to that list Martin Fleischmann, Stanley Pons, and many of the people in this very room today.

It is nearly impossible to fathom that despite living in the modern age where advances in science, medicine and technology arrive at seemingly lightning speed, that there are those who would argue that condensed matter nuclear science is not even worth the effort of exploring. They would keep our work in the shadows, and insist that the public must not know about our research—for fear that they might share our hopes and dreams for a better tomorrow.

But for those of us here tonight, I say: stay the course, because our time is now.

Some members of the Energetics group: Shaul Lesin, Irv Dardik, Alison Godfrey, Vitaly Krakov, Tatyana Zilov, Ehud Greenspan, Mark Tsirlin, Arik El-Boher. Photo by Duy Tran.

ICCF14 Group Shot (by Duy Tran)