

Notes from the
12th International Conference on Condensed Matter Nuclear
Sciences

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The following brief summary refers to only some of the 60 papers presented at the conference.

Experiments

Yasuhiro Iwamura (Mitsubishi Heavy Industries) presented more data on transmutations of Cs to Pm, Ba to Sm, and Sr to Mo, using a variety of diagnostic techniques, including a detailed surface mapping using a synchrotron microbeam (100 x 100 micrometers). They found that the transmutations occurred in small concentrated sites on the surface. Afterward I asked him what labs have reproduced some of his transmutations, and he said Osaka University, Shizuoka University, Francesco Celani (Italy), and NRL (in progress).

A. Kitamura (Kobe University) coated films on the *vacuum* side of the Pd foil (Iwamura coated the *gas* side) and reported transmutation of Sr into Mo.

Irina Savvatimova ("Luch" Institute, Moscow) reported transmutation of Ba into Sm.

A. El-Boher (Energetics Technologies, Israel) used "superwave" modulation of the current in electrolysis cells to increase yield. He achieved 600% excess heat for 24 hours, and 150% for 134 hours. Irving Dardik (a physician) developed the superwave technique with regard to curing human illnesses, and it is found to have applications in several fields.

Vittorio Violante (ENEA, Italy) used a HeNe laser to enhance excess power generation during electrochemical loading.

Yoshiaki Arata (Osaka University) observed intense heat generation during ingress of deuterium into a thin cylinder containing Pd nanoparticles.

Alexander Karabut ("Luch" laboratory, Russia) observed excess heat generation and transmutations during deuterium glow discharges, but not during Kr or Xe discharges. Using spark mass spectrometry, SIMS, and secondary neutral mass spectrometry they identified the emergence of many impurities, including abnormal isotope ratios for several elements. They also observed emission of gamma rays and x-rays.

Andrei Lipson and George Miley (Lebedev Institute, Moscow, and University of Illinois) reported emissions of energetic protons and alpha particles during controlled exothermic deuterium desorption from the surface of a Pd/PdO:Dx heterostructure. Using CR-39 detectors they found 1-3 MeV proton tracks and 11-16 MeV alpha tracks, with a yield about 0.005

alphas/cm²-s, reproducible during about 20 experiments. They also reported data indicating superconductivity in Pd hydride and deuteride.

Francesco Celani (Frascati, Italy) told how they coated Pd wires with Pd-silicate to produce fractal nanostructures and enhance deuterium loading.

Vladimir Vysotskii (Kiev) and Alla Kornilova (Moscow) reported that Mn-55 was transmuted into Fe-57 in a solution of MnSO₄ in heavy water plus nutrients and microbes, and the yield after 30 days was about 10⁻⁶. In light water no Fe-57 was produced. They have published a book on this topic.

Experiments at Iwate University were not yet successful. During the discussion I pointed out that oxides of calcium, strontium, and barium are used in commercial vacuum tube cathodes, and that great care must be taken in vacuum tube manufacture to avoid impurities like oil, which can poison their thermal emissivity. Experiments that attempt to emulate the transmutation data of Iwamura may fail if they do not bake out the sample in a very clean high vacuum system.

Mike McKubre (SRI) presented new data to clarify the relationship between the electrical resistance ratio R/R₀ of Pd and the fractional loading of deuterium near N(d)/N(Pd) ~ 1.

Jean-Francois Fauvarque (Laboratoire d'Electrochemis Industrielle, France) reported reproducible heat generation during electrolysis with a tungsten cathode. At 350 V the output energy was 1.3 to 1.4 times the input energy.

Tadahiko Mizuno (Hokkaido University) described an electrolysis experiment in which the cathode overheated and exploded. After 300 J electrical input, the output heat plus explosion energy totaled about 0.24 MJ. Analysis of the tungsten cathode revealed deposits of Ca, S, and other elements, but no residual radioactivity.

There is a new collaboration between Italy and Japan (Takahashi, Celani, Iwamura) to try to transmute radioactive isotopes such as Cs-137 and Sr-90 into stable isotopes, which could have application for remediation of radioactive wastes. I. Goryachev (Kurchatov Institute) is also studying the possibility of waste remediation.

Jean-Paul Biberian (Marseille, France) heated a clean Pd foil to 500 C, cooled and sanded it, heated again to 500 C, and coated it with Zn, Pb, or Li. When the coated foil was immersed in deuterium gas it loaded quickly and generated excess heat.

Steve Krivit (New Energy Times) and Vladimir Vysotskii (Kiev) told of experiments by A. Koldomasov (Russia), Hyunik Yang (Hy-En Research Co.) and others involving flow of high-pressure machine oil or water through a small orifice (~ 1 mm). There are experiments Korea and in Edmonton, Canada, and theoretical work in Russia. Krivitt showed a videotape of the Canadian device in action. In boron-doped oil at 30 atm the color is tawny; at over 40 atm, it is white; at over 60 atm it is clear, with a blue plasma jet downstream of the orifice. At 70-80 atm there is a bright blue beam 6 mm in diameter, and at over 90 atm a green glow appears upstream of the orifice. Hard x-rays were observed from the luminous region. The researchers claim that excess heat is generated from fusion reactions (possibly protons plus boron-11) during collapse of cavitation bubbles, and they detected He-4 emission lines from the cavitating fluid.

Andrei Lipson and George Miley (University of Illinois) showed that the walls of high-power tokamaks like ITER could be damaged by low energy nuclear reactions induced by implanted deuterium and tritium.

Theory

F. A. Gareev (Dubna, Russia) stated that he derived the Bohr hydrogen atom conditions from a Hamiltonian without reference to Bohr conditions or quantum mechanics. He said that quantum theory should be reformulated for open systems, and that atoms are self-organizing systems in which standing waves are synchronized by resonances.

John Fisher (USA) suggested that under some conditions in lattices polynuclear clusters may form and stimulate nuclear transmutations.

Akito Takahashi (Osaka University) noted that 150 theoretical models have been proposed to explain low energy nuclear reactions. He hypothesizes that inside a crystal lattice four deuterons plus four electrons can coalesce to form a “tetrahedral symmetric condensate”, which can interact with the host atoms’ nuclei, and he estimated the corresponding reaction rates.

Xing-Zhong Li (Tsinghua University, Beijing) discussed calculations of internal reflection and multiple scattering of deuteron waves. The symmetry of the lattice planes may help sustain the deuteron wave nature against lattice vibrations. Even if the absorption in a single layer is very low, the total absorption from multiple layers may be significant.

Scott Chubb (NRL) and Talbot Chubb pointed out that in finite chunks of lattice the end boundary conditions invalidate some of the ideas that hold for infinitely long media. Bloch deuterons may occur along the interface between Pd and CaO. The salt provides a lattice and the metal provides free electrons to neutralize the deuteron charge. Communication occurs between deuterons in octahedral and tetrahedral sites of the Pd. Tunneling depends on crystal size. Tiny 6 nm crystals with tunneling times in microseconds either cannot provide enough momentum to initiate dd fusion or they conduct ions so rapidly that collisions occur. Medium sized 60 nm crystals load rapidly and create heat. Crystals larger than 60 microns have tunneling times longer than a month, which is too slow.

Yeong Kim (Purdue) presented a new theory that uses a Lorentzian broadening of the Maxwell-Boltzmann distribution that was formulated by in the 1930s. With this broadening phenomenon he predicts much higher nuclear reaction rates in solids.

Using a Hamada-Johnson potential Peter Hagelstein and I. Chaudhary (MIT) have computed 400 matrix elements for deuteron interactions with phonons. They will soon be able to predict various reaction rates to test their theory of phonon interactions stimulating nuclear reactions.

William Collis reported that the new International Society for Condensed Matter Nuclear Sciences (ISCMNS) has over 170 members. Its motto is “Ardet nec consumitur”, which means, “It burns, but is not consumed”.

Summary

In his summary of the ICCF-12 conference Prof. Xing-Zhong Li said that CMNS has three “legs”:

- excess heat generation
- nuclear reaction products & transmutations
- good reproducibility.

Many experiments have achieved the first two legs, but reproducibility has only been demonstrated in a few experiments, such as those of Iwamura. Prof. Arata is building a larger device (3 x 30 cm) to demonstrate reliable higher power operation.

There are new companies investing in CMNS (D2Fusion and Energetics Technologies) and new international research collaborations of SRI-Israel-Italy and of Italy-Japan. The double-structure work of Arata demonstrates clear evidence of heat generation during deuterium flow in Pd, and the work of Iwamura provides additional detailed measurements of transmutations. Several theorists are making good progress towards understanding the phenomena, such as the deuteron wave theory of Chubb. The US Department of Energy review of CMNS was favorable, and DOE is now willing to consider research proposals. The Journal of Fusion Energy (edited by Steve Dean) is willing to accept papers dealing with CMNS. Li stated that three of the suggestions made by Dolan at ICCF-9 (Beijing, 2002) [1] are now being fulfilled:

- a new technical society (the International Society for Condensed Matter Nuclear Sciences),
- an award for great achievements (the Preparata Award)
- a new journal (formation in progress).

The next conference ICCF-13 will probably be held in 2007 in Russia or in the USA.

1. Dolan, T.J., *Notes from the 12th International Conference on Condensed Matter Nuclear Sciences*. 2005: Yokohama, Japan. <http://lenr-canr.org/acrobat/DolanTJanoutsider.pdf>