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Research Article

Coenergy Enables Force Calculations and Loading Measurement

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Abstract

Coenergy is used to include magnetic fields in linear, conservative systems. It permits easy derivation of force. With an additional technique, it enables loading measurements without interrupting the electrical current flow. Coenergy analysis can also measure induced and remnant magnetization in NANOR®-type CF/LANR components.

Keywords: NANOR, LANR, Fusion, Loading, Magnetoelectric, Coenergy, Ohmic control

1. Introduction – Coenergy Is Key to Understanding LANR Systems

Thirty-seven years of sterling evidence shows conclusive LANR data proving its excess heat is of a nuclear origin, in both aqueous [1]–[3] and dry, preloaded [4]–[8] cold fusion/lattice assisted nuclear reaction systems and components. Successful cold fusion (LANR) therefore begins (and continues) with loading; the metallurgy is complex and well-studied [9]–[10].

Future LANR investigations will be helped by considering coenergy. The coenergy quantity [W'_m] is an alternate definition of the energy term in linear, conservative systems [11], and it is used in continuum electromechanics, electrophysics and electrical engineering to include magnetic fields. With the additional techniques shown below, it also enables loading measurements without interrupting the electrical current flow, and the measurement of induced and remnant magnetization in NANOR®-type CF/LANR components.

The reasons for this are that the mechanical forces are easily derived from a simple spatial derivative, of the following equation used.

$$\mathrm{W}'_{\mathrm{m}} = 1/2\,\mathrm{m} * \mathrm{H}^2$$

Because the derivation of force in magnetostatic system is simply the negative spatial gradient, which enables a fusion cathode to have its mass (and therefore deuteron population) is measured *in situ* without interrupting the electrical current flow. Therefore, increasing the cathode mass by loading will decrease the frequency of a vibrating cathode. The equation of motion, with terms including magnetostriction, is

$$\frac{d^2x}{dt^2} = -\left[K * x\right] - \frac{\left[Bo\right]^2}{2 * \mu^2}\left[\Delta\mu + \left[(-\Delta\rho) * \left(\frac{\delta\mu}{\delta\rho}\right)\right]\right]$$

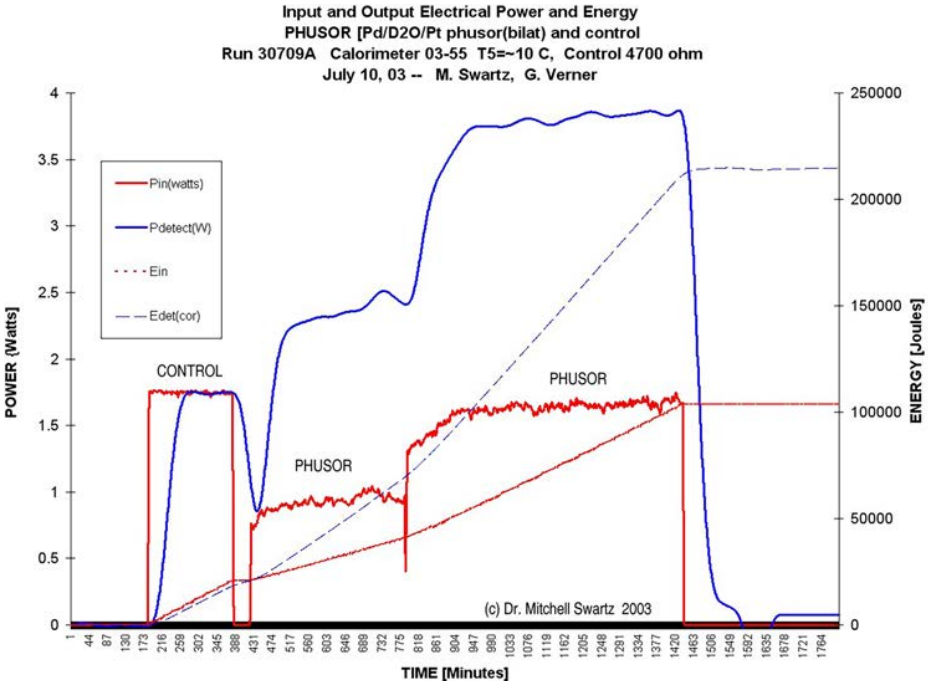


Figure 1. Active Aqueous Pd/D_2O/Pt Systems Reproducibly Produce Excess Heat. Shown is the input electrical power (red lines), and heat output (blue lines), to the ohmic control and to the aqueous heavy water PHUSOR®-type system, as a function of time. Also shown is the input and output electrical energies (the blue and red dashed lines).

The solution of the equation has an amplitude, and natural frequency, of

$$\frac{[Bo]^2}{2 * V * \rho * \mu^2 * K * \sqrt{(\omega_0^2 - \omega)}} * \left[\Delta\mu + \left[(-\Delta\rho) * \left(\frac{\delta\mu}{\delta\rho}\right)\right]\right]$$

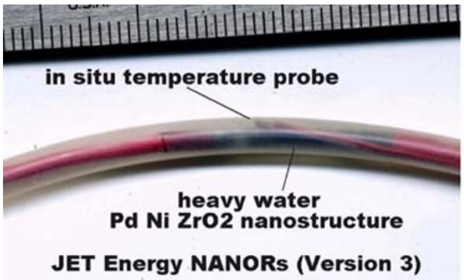
$$\omega_0 = \sqrt{\frac{K}{\rho * V}}$$

The magnetoelectric term at the end of the equation above is similar to that term from conventional dielectrophoresis. In the equation, K is representing the first order spring constant, which arises from the frictional force exerted back on the cathode.

2. Background: COLD FUSION/LANR is ABSOLUTELY REAL

Loaded deuterons in PdD (often under difficult-to-achieve conditions) couple together in these active systems thereby fusing to generate *de novo* ^{4}He and considerable excess heat [with an example shown in Figure 1], and with loss of D and generation of unique optical antiStokes and RF [Deuterium-line] emission signatures.

Figure 1 shows these reproducible Excess heat (XSH) results with clear comparisons to ohmic control. Excess heat was not seen in any of the ohmic controls. However, there is LANR activity. Excess power (beyond that applied)



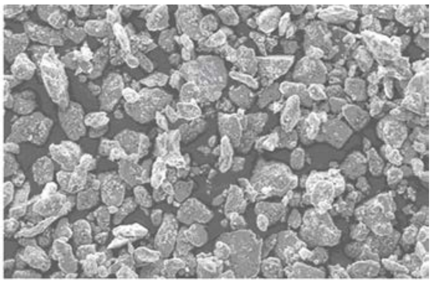


Figure 2. NANOR®-type Preloaded CF/LANR Component. (left) Series 3 NANOR®-type LANR Component, (right) Dry, preloaded ZrO_2-PdNiD nanostructured core material.

can be easily seen. Notice closely that the energy curves rise in parallel for the ohmic control when there is no excess heat, but not if excess heat is being produced. Note that with XSH the incremental (excess) energy curves rise in a supra-linear way when constant input is applied.

3. Background IMPORTANT: Loading is KEY to LANR Success Including With NANOR®-type LANR Components

NANOR®-type LANR components are a new generation of dry, CF/LANR nanomaterial PdD (and sometimes with PdNiD) quantum electronic devices, sealed into an electrically conductive (high impedance) configuration, exhibiting considerable energy gain. Most importantly, the activation of the cold fusion/lattice assisted nuclear reaction is, for the first time, separated from loading.

4. Experimental –ZrO_2-PdNiD NANOR®-type LANR Component

These important, novel devices feature two terminals with a cylindrical shape and active CF/LANR core and self-contained superior handling properties enabling portability and transportability [Figure 2]. Thus, they are incredibly useful and have demonstrated a more reproducible CF/LANR behavior. The self-contained two electrical terminals NANOR®-type components are fully preloaded with deuterons. They are $\sim$2 cm in length, with 30 to $\sim$ 400 milligrams of a LANR active nanocomposite ZrO_2-PdD core. The core is ZrO_2-PdNiD [Zr ($\sim$66%), Ni (0-30%), and Pd (5-25%) by weight] with additional D. The PdNiD nanostructured core islands are electrically isolated by the zirconia (ZrO_2) dielectric. Their power density $\sim$19.50 watts/gram of nanostructured material helps their already superior handling properties and portability.

5. Experimental - Electric Power Drive

Calibrated measurements require a timely compared ohmic control. For each step pulse, the thermal ohmic control and then the components are examined by driving them with a constant input power. This provides heat at a constant rate, along with the electrical dissipation (V*I), which are maintained over a long period of time.

Ohmic calibration is important in several ways. In addition to calibrating the calorimeter, it also establishes the baseline by first measuring and observing the response of the ohmic control. We match the electrical input power to both the ohmic control and the LANR component. Measurement of energy, obtained through time integration of the power, is necessary to also prove one's analytic system is correct, and to rule out phase changes. Several types

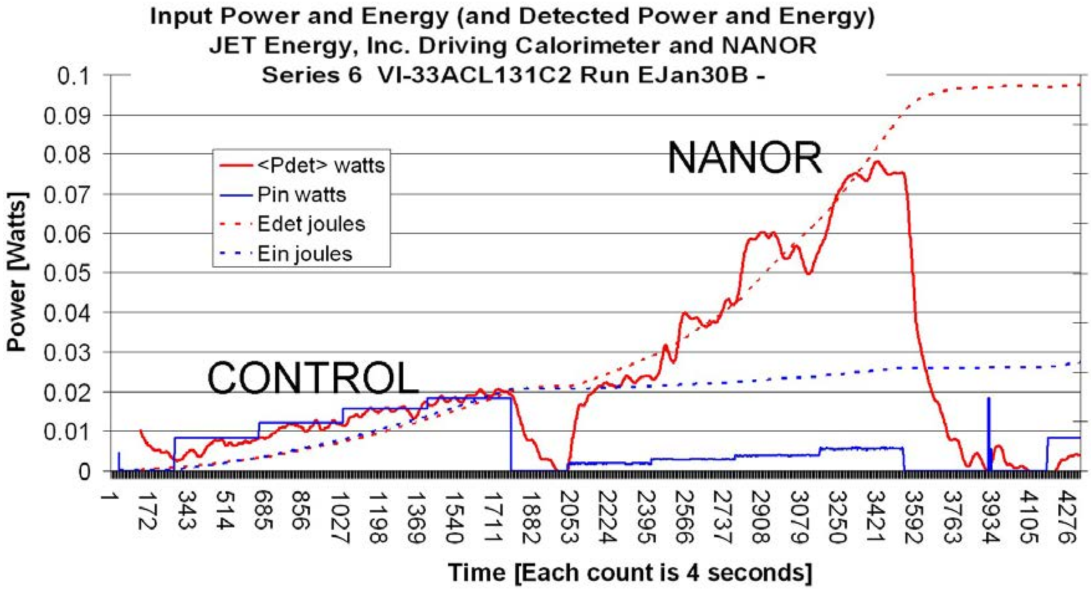


Figure 3. Preloaded, Dry NANOR®-type Component Reproducibly Produces Excess Heat. - Shown are the input electrical power (red lines), and heat output (blue lines), to the ohmic control ["CONTROL"] and to a Deuteron-preloaded, dry NANOR®-type Component as a function of time. Also shown is the input and output electrical energies (the blue and red dashed lines).

of temperature detection methods are used while electrically driving the system. In addition to our publications, we include custom DS18B20 temperature sensors.

6. Results - Active Dry Preloaded NANOR®-type LANR Component

Figure 4 below, shows the applied input voltage and resultant incremental power gain for NANOR®-type Component N5-02A, calibrated by an ohmic control resistor in run EJan01A. Note how many orders of magnitude the incremental power gain [excess heat ["XSH"]] realized from the active NANOR®-type component compared to the ohmic control. Achieving these high incremental power gains has required improved alloys and their loading by deuterons, followed by meticulous avoidance of electric avalanches and extending the duration of the heat production cycles. Cathode vibration enables hydrogen (or deuteron) loading measurement. Furthermore, other benefits arise from an arrangement enabling an external magnetic field.

Figure 3 shows a salient excess heat (XSH) result for the NANOR®-type component compared to the ohmic control. Excess heat was not seen with any of the ohmic controls. However, there is obvious desired LANR XSH-generating activity, and the excess power can be easily seen, as it is far beyond the input power applied.

Upon close observation, one can also see that the energy curves rise in parallel for the ohmic control, unlike later when excess heat was actually produced by CF/LANR. Note that with XSH, the incremental (excess) energy curves rise in a supra-linear way when constant input is applied to the NANOR®-type component.

Also, in Figure 4, it is shown that there is a clear increased temperature rise for the NANOR®-type component compared to the ohmic control – even with less input power.

There is thus a clear, salient result demonstrating the desired excess heat with its temperature generating activity.

Again, it is important to note that such excess temperature rise was NOT seen with any of the ohmic controls.

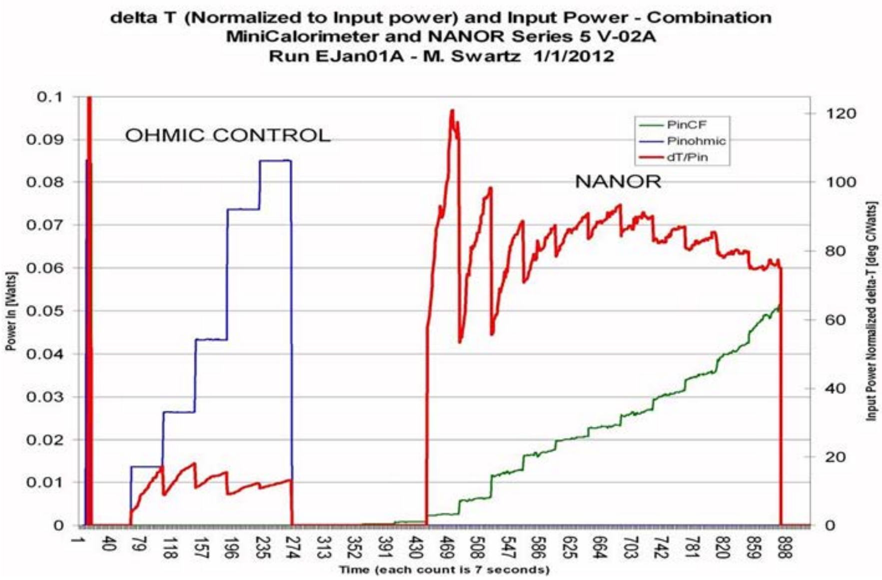


Figure 4. Preloaded Pd-NANOR® V-02A Reproducibly Produces More Heat. Shown are the input electrical power (blue and green lines), and the generated temperature (red lines), to the ohmic control ["CONTROL"] and to a Deuteron-preloaded, dry NANOR®-type component, as a function of time.

7. Results - Vibration of Electrode To Monitor Loading

A palladium electrode has the unique property of internally filling ("loading") with hydrogen, as a sponge fills with water. A 'vibrational electrode' can be monitored for its natural frequency revealing information about the electrode, including "how much" hydrogen has been loaded (through the mass change; see Figures 5 and 6). Monitoring of hydrogen, or deuteron, loading used to be complicated and invasive and actually stopped the desired reactions underway.

However, electrically uncoupling the electrode ["effectively pulling the plug" and stopping the reaction], cross-contaminating the cathode and the laboratory by physically removing the electrode, drying it off, and actually weighing it on a scale, before returning it to the disrupted electrical circuit – is no longer required.

By contrast, vibrational in situ monitoring is non-invasive and does not disturb the reactions - features of great and significant utility. This cathode vibration enables hydrogen (or deuteron) loading measurement.

Furthermore, other benefits arise from an arrangement enabling an applied external magnetic field. In addition to inducing a vibrational frequency of the cathode, the magnetic field can be used to increase the incremental power gain or collect a product.

8. Results - Coenergy Analyses Can Reveal the Force Induced, and Remnant Magnetization of Nanomaterial LANR Components

In addition, by this process, LANR domains can also become magnetic, interact, and can be followed over time. This is shown in Figure 7. LANR's fuel is abundant. Clean, quiet, and LANR engine-motor systems will drive electrical generators to provide propulsion and transportation. There is more available energy from LANR than from all the Earth's oil reserves.

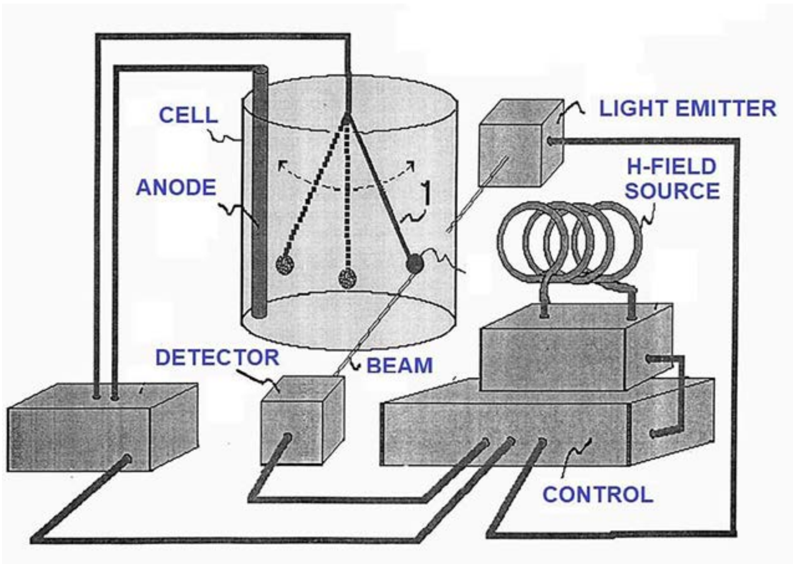


Figure 5. Apparatus and Process To Monitor Electrode Loading By Vibration. Serial No.: 16/501,347; a Continuation of SN 07/371,937, Filed 06/27/1989.

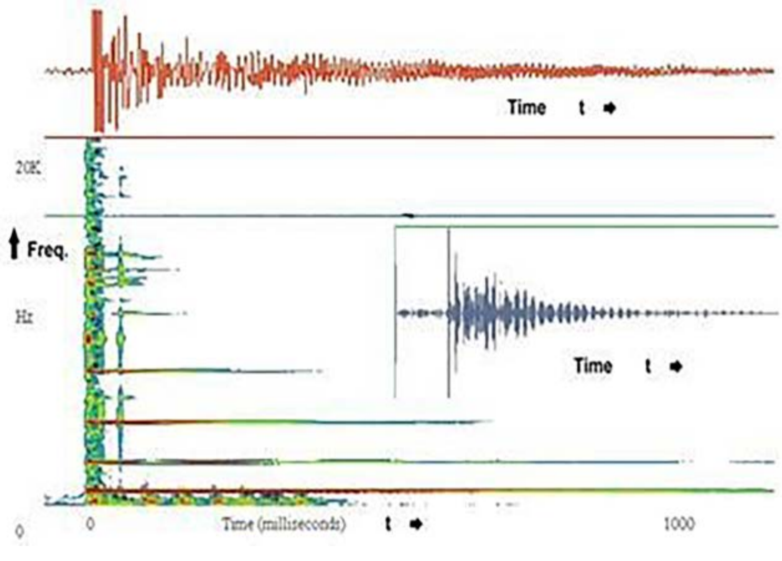


Figure 6. Coenergy Drives and Then Enables Measurement of Loading - The Vibrating Cathode, its Fourier Transform, and calibration, are shown. The cathode was #92505bjNi-B2 immersed in ordinary water. Short-lived vibrational modes are revealed here by FFT. A calibration signal was also inserted at 17,390+/-53 Hz (blue horizontal line, approximately half-way up the image). The sampling rate was $\sim$100 kilohertz.

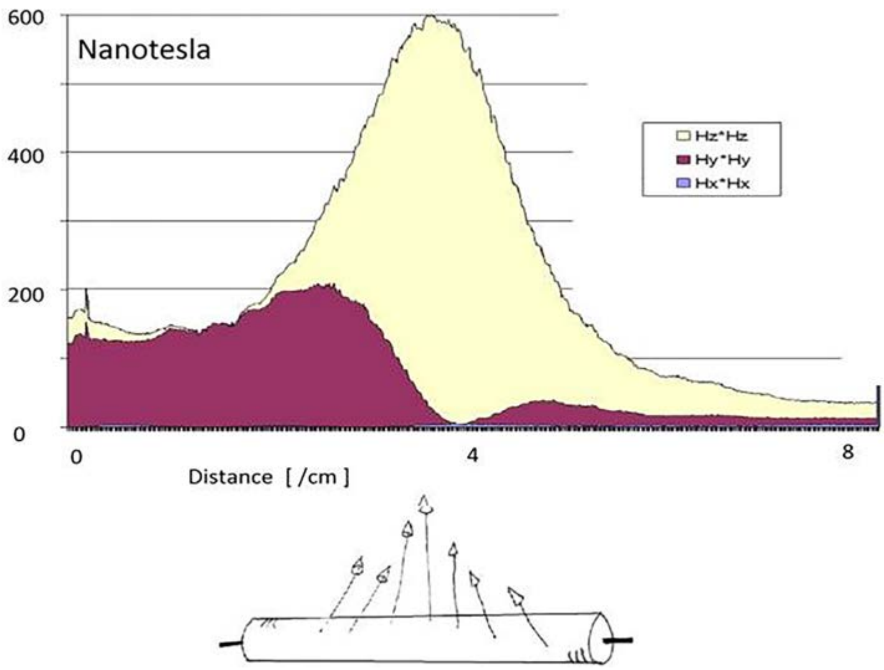


Figure 7. Coenergy Analysis can Reveal the Force Induced, and the Remnant Magnetization Coenergy Enables Measurement Induced Magnetic Microdomains. Magnetic Domains in this run used NANOR®-type component N7-8M and were detected [magnetization in nanotesla] as shown long after it was previously operated. The measured vectorial magnetization scan is shown along the component's entire body in the inset, below the graph.

9. Conclusion – Coenergy has Multiple Uses in CF/LANR

The secret of successful LANR/CF is deuteron loading into palladium (or other alloys). Measuring that loading can be made easily by an electrode vibration, which reveals the mass of the electrode. That electrode vibration can be ephemeral and can be initiated in oscillation by a magnetic field. The coenergy analysis can also reveal the induced force and help measure any remnant magnetization.

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