Rapid Quenching Methods for Fabricating Exothermically Responsive Cathodes

TECHNICAL AREA:

The technical area of this disclosure relates to fabrication of a cathode that will produce exothermic reactions when the cathode is highly loaded with deuterium gas.

BACKGROUND:

A seventeen-step protocol developed by the inventors has been shown to produce bulk cathodes that produce exothermic reactions when irradiated by single and dual laser stimulation (Reference 1). Three steps in the protocol call for cooling the fabricated cathode slowly, which produces an oxide layer on the cathode (typically palladium bulk foil). Subsequent to developing the slow-cool protocol, the applicant discovered experimentally that rapid cooling of the cathode avoids the oxide layer formation and appears to produce cathodes that produce exothermic reactions more reliably than the slow-cooling method.

EXISTING TECHNOLOGIES:

At the present time, bulk foil cathodes for laser stimulation are fabricated following the applicant's 17-step protocol. Three of the steps call for the cathode to be heated to 750 °C, then 850 °C and cooled slowly to ambient temperature over 8-10 hours, as shown in reference 1. The slow-cool method produces a blue-green oxide layer on the cathode, which must be subsequently removed by acid etching with Aqua Regia as shown in Figure 1.

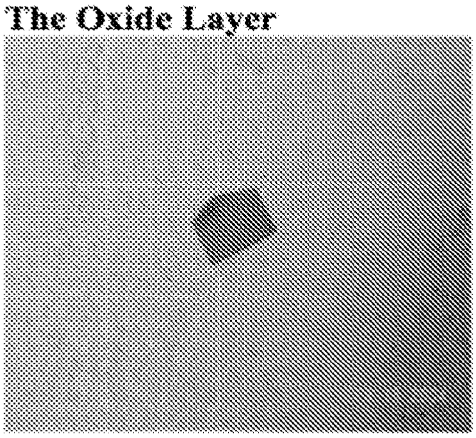

Figure 1

PROBLEMS WITH EXISTING TECHNOLOGIES:

It was found experimentally that cathodes produced by the slow-cool method sometimes failed to produce exothermic reactions. It was thought by the applicant that formation and removal of the oxide layer might be responsible for variations in reproducibility.

SUMMARY OF THE PROPOSED SOLUTION AND THE ADVANTAGES THE PROPOSED SOLUTION PROVIDES:

The proposed solution is to avoid the oxide layer formation by rapid cooling of the cathode material during the fabrication process. This method produces a cathode free of oxide formation and can receive a light acid treatment to produce a roughened cathode surface.

DETAILED DESCRIPTIONS OF THE PROPOSED SOLUTION AND FIGURES:

The metallurgical field is familiar with accelerated quenching methods, as discussed in references 2 or 3. Rapid quenching is known to “quench in” vacancies produced at high temperature so they remain in the host metal at lower temperatures. Further, it is conjectured by LENR theorists like professor Hagelstein of MIT that deuterium can enter vacancies to produce exothermic reactions and stabilize the vacancies. This idea is supported by experiments conducted by the applicant.

Reference 2 discusses quenching methods on page 708 and the rate of cooling can control the final outcome of the crystal structure and the crystal structure of the host metal often determines the level of heat produced by the cathode under test. The known quenching methods are air, oil, water, and brine. Liquid quenching provides the fastest cool-down and can be done with or without agitation.

This disclosure claims that all rapid quench methods would likely be useful to apply to cathode fabrication but so far only the air quench method has been tested in the laboratory.

The air quench method begins as shown in Figure 2.

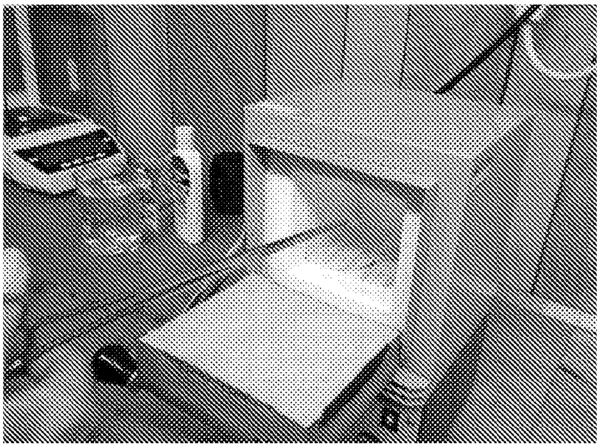

Figure 2

The cathode is heated to red heat according to the protocol but is rapidly removed from the furnace with a pair of tongs and placed on a stainless steel or aluminum block for rapid cooling to ambient temperature. Variations of this method are to chill the metal blocks to freezing or below. Another variation is to add a frozen puddle of D_2O on top of the metal blocks and place the cathode on top of the ice. The rapid melting of the ice provides agitation of the cathode surface, cooling the cathode at a faster rate. This produces a cathode without the oxide layer shown in Figure 1 and retains the increased concentration of vacancies due to heating.

The efficacy of the rapid air quench method was experimentally demonstrated on July 21, 2016 at the laboratory of Industrial Heat of Raleigh, North Carolina. For about one year, the principal investigator, T Barker Dameron produced and tested cathodes for heat using the slow-cool method. Two small inconclusive heat events were observed. In

May 2016 the applicant made a cathode using the rapid air quench method with very clear positive heat results as shown in Figure 3.

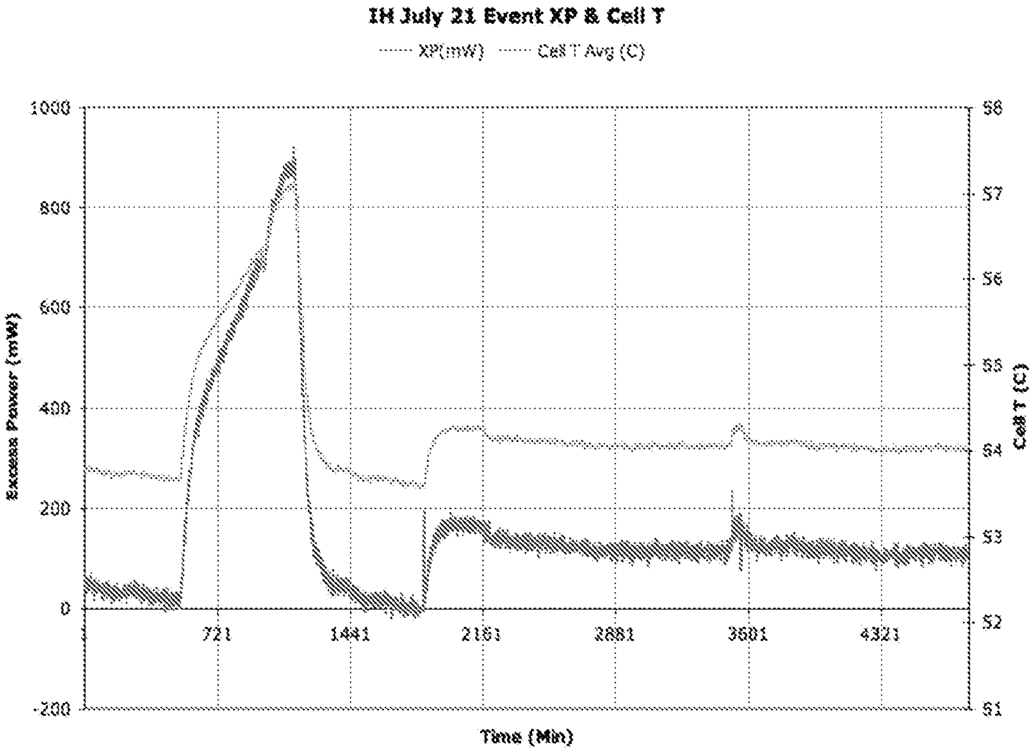

Figure 3

A beat frequency stimulation of 15 THz from two red lasers with a combined radiant power output of 50 mW produced a 4 °C temperature increase in 100 mL of LIOD. This is clearly an unexpected thermal response that was not observed in testing with other cathodes over the previous year.

REFERENCES:

1. Slide set “Cathode Fabrication Methods to Reproduce the Letts-Cravens Effect”.
2. Physical Metallurgy Principles, Second Edition, Robert E. Reed-Hill
3. Physical Metallurgy, third edition, Chapter 10, Peter Haasen