Heat generation from Hydrogen/Deuterium Pressurization of Nanoparticles: Composition and Temperature effect on Heat Output

#Tapan Patel[1], Erik Ziehm[2], Bert Stunkard[2], Kathleen Weichman[2], Anaïs Osouf[2], Kyung-Shin Lee[2], Kyu-Jung Kim[2], G.H. Miley[2]
[1] University of Illinois, Champaign, IL, U.S.A, tcpatel2@illinois.edu
[2] University of Illinois, Champaign, IL, U.S.A

Research in support of small distributed LENR power units is reported [1]. Findings will be discussed from studies of heat generation resulting from pressurization of various nanoparticles with either hydrogen or deuterium, depending on the composition. The effect of composition was studied using three different particle alloy compositions, composed of various amounts of nickel, palladium and zirconium. After pre-treatment, the particles were pressurized with hydrogen and/or deuterium. Results for the peak power density from these runs are presented in Table 1. The runs were conducted at room temperature with 2 g of the particles but the results are normalized to a per gram basis. The results are presented for each particle type and are the average of multiple runs for each composition:

Table 1: Particle types, composition and associated maximum power density

Particle Type	Particle composition	Loading Gas	Maximum power density (J/g)
Type A	Pd-Zr	Deuterium	15
Type B	Pd-Zr-Ni (High Ni,Pd)	Hydrogen	21
Type C	Pd-Zr-Ni (High Ni, Low Pd)	Hydrogen	7.8

In the second study, the pressurization of 2 grams of particle Type A with Deuterium was run under 5 different initial temperatures ranging from room temperature to 300 C. Two experiments were conducted for each temperature to produce a total of ten runs. The same particles were used for each of the runs which allowed a study of degradation in the particles and corresponding heat output [2]. Results indicate that the initial temperature plays an important role in the total heat output. As shown in Figure 1, the total heat generation shows an approximate linear correlation with the starting temperature. The figure also shows the peak power output as well as the corresponding output from the first and second rounds of runs.

Comment [L1]: weight?

Two second round cases are not included in this comparison due to incomplete data.. In one case (250 C) the total heat production remained unchanged while the peak power decreased. In the remaining cases, both the total heat and power production were diminished. The difference in total heat production between the two rounds ranged from 16% to 35%.

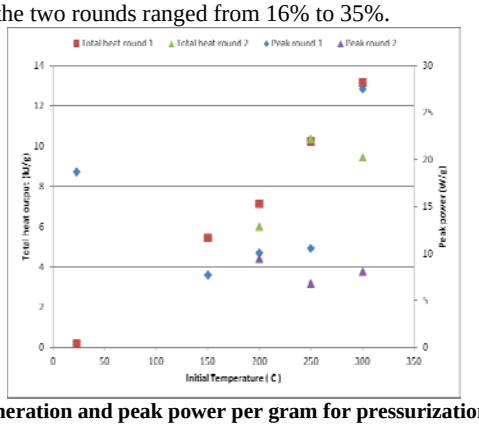

Figure 1: Total heat generation and peak power per gram for pressurization of nanoparticles as a function of temperature

[1] G. H. Miley, et al., "A Distributed Power Source Using Low Energy Nuclear Reactions, submitted, this meeting.
[2] Anaïs Osouf, et al., "Composition measurements and Imagery of Nanoparticle gas loading experiments as an investigation of LENR reactions", submitted this meeting.