Distributed Power Source Using Low Energy Nuclear Reactions

#George H. Miley[1,2], Kyu-Jung Kim[1], Tapan Patel[1], Erik Ziehm[1], Bert Stunkard[1], Kathleen Weichman[1], Anaïs Osouf[1], Kyung-Shin Lee[1]

[1] University of Illinois, Urbana-Champaign, U.S.A, ghmiley@illinois.edu

[2]LENUCO, LLC, Champaign, Il 61821, USA

This project is focused on development of a revolutionary new distributed nuclear power unit using Low Energy Nuclear Reactions (LENRs). This will allow small power units that represent a vital new power supply for both home and light industry power. Due to the low energy of reactants, the compound nucleus formed in LENR has little excess energy, thus the resulting breakout products are mainly channeled into stable or near-stable products, avoiding significant radioactivity or nuclear waste problems. Such a power source enables a tremendous advantage in energy density, lifetime, and tolerance to wide differences in environmental conditions (temperature, pressure). Compared to other renewable power units, LENR units offer significant technical and economic advantages.

During the past decade, extensive experimental and theoretical work has been done worldwide to study the LENR phenomena and to understand its underlying physics. At ICCF-17 several companies announced progress on gas loaded nickel nano-particle units designed for MW size plants. Others, including LENUCO LLC., are working on development of small 10's of kW units. Physically these power units are very simple. Special Ni alloy nano-particle is placed in a pressure vessel which is then pressurized to 60-100 psi with hydrogen to initiate the reaction. With pressure control, these units are expected to run for several years, before replacement of the nano-particles is required due to build up of transmutation products. Replacement is simply done by substitution of a new cylinder containing fresh particles while the used particles are recycled for use in fresh nano-particles. Our results in terms of energy gain from the pressurized nano-particles are among the best reported to date [1, 2]. The main obstacle to development of a practical unit is preventing the hot nanoparticles from overheating and agglomerating together, limiting unit run time [3]. Thus present work is focused on overcoming that problem as well as further development of the technology needed for a practical power unit.

A gas loading system has been devised using a nickel based alloy nano-particle that provides a large output of heat when pressurized to 60~100 psi with hydrogen (alternately deuterium gas using a Pd rich version of the nano-particle alloy can be used).The discovery at the University of Illinois of the existence of Ultra-High-Density clusters inside the host material is a break-through development [1]. Both experimental and theoretical studies have demonstrated that the hydrogen atoms in these clusters (almost metallic hydrogen) are close enough together that diffusion of another atom into the cluster transfers sufficient momentum to create a nuclear transmutation reaction with the hydrogen and host nickel atoms. Incorporating these clusters into the material has resulted in excess heat experiments that reproducibly producing orders of magnitude more heat energy out than energy in. However, as noted earlier, run times are currently limited to hours by the onset of nano-particle agglomeration.

References

[1] George H. Miley, Xiaoling Yang, Kyu-Jung Kim, Heinrich Hora, "Use of D/H Clusters in LENR and Recent Results from Gas Loaded Nanoparticle-Type Clusters", *Proceedings, 17th International Conference on Condensed Matter Nuclear Science (ICCF-17)*, Korea, 2012.

[2] Tapan Patel, et al., " Heat generation from Hydrogen/Deuterium Pressurization of Nanoparticles: Composition and Temperature effect on Heat Output", submitted, this conference.

[3] Anaïs Osouf, et al., "Composition measurements and Imagery of Nanoparticle gas loading experiments as an investigation of LENR reactions**",** submitted, this conference.