Preface

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Low-energy nuclear reaction research is unlike thermonuclear fusion research. Many publications report on various LENR methods by which nuclear reactions are produced and demonstrated at room temperature. The experimental methods to demonstrate these phenomena range from the use of gunpowder and laser techniques to the attempt to electrochemically induce nuclear fusion and fission and create significant excess heat within the palladium or nickel metal lattice exposed to a deuterium- or hydrogen-containing solution.

Palladium is well-known for its ability to absorb large quantities of hydrogen/deuterium into the bulk metal, where the nuclei, electrochemically inserted, occupy interstitial octahedral/tetrahedral sites dependent on the specific palladium–deuteride/hydride phase. Using this approach, Martin Fleischmann proposed the idea of electrochemically inserting deuterium into bulk palladium so that the probability for deuterium nuclei to react and collide efficiently might increase.

Based on this idea of generating nuclear fusion within the metal lattice in 1989, Fleischmann and his colleague Stanley Pons designed an experiment involving an electrochemical cell using a heavy-water solution with the corresponding electrolyte and a palladium cathode. The energetic output generated after many days of electrolysis was found to be many orders of magnitude higher than expected on the basis of any known chemical reaction, and from this Fleischmann and Pons concluded that a nuclear reaction involving deuterium nuclei inside the palladium metal had occurred.

This phenomenon, initially named "N-fusion" by Fleischmann and Pons and promoted by the University of Utah as an opportunity to solve the energy problems of the future, instantly attracted worldwide attention. As quickly as the fusion phenomenon became the most crucial and important science topic of the day, the interest declined because of the lack of reproducibility.

Research scientists from all over the world, after learning of the news announcement, attempted to replicate the experiment in their labs. Unfortunately, most of them lacked crucial information about the experiment. This, together with the well-known contradiction in physics that deuterons are very unlikely to collide efficiently at room temperature because of the enormous amount of energy required to overcome the Coulomb barrier, caused mainstream science to dismiss the entire subject as error.

Twenty years later, we can see that progress came slowly but steadily. The few scientists who maintained an open interest and continuing commitment to explore the unknown had to contend with the shame and disgrace of being associated with a field of science that had been labelled illegitimate.

Some of the LENR scientists have worked on replications of the original Fleischmann-Pons electrolysis experiment. Many others have explored new ground, performing experiments with deuterium gas and a variety of approaches.

Many of these approaches and effects go well beyond the initial Fleischmann-Pons electrolytic effect.

The researchers have set out to determine and evaluate the experimental parameters that may play a significant role in this process and to give plausible explanations to theoretical approaches. The work they have done is tremendous, and comparing the experimental results achieved, combined with the profound understanding of the LENR process they have acquired, suggests a promising research topic to discover and exploit perhaps the most auspicious alternative energy source.

With limited funding and maximum resistance from science orthodoxy, the LENR scientists succeeded, regardless of the small and at times non-existent research budgets available to them. Their efforts are characterised by hard work and intensive research performed in their mostly privately funded labs, in loneliness, without acknowledgment and recognition, separated and isolated from mainstream science. That was the past. The research has now achieved notable recognition as a new, legitimate field of science, and LENR is now poised to become a significant part of the future of science.

Although LENR may become an option to provide energy for private households, industry and the transportation sector, running the economy on the basis of an intensive use of a raw material as costly as palladium is impractical and, in the long term, perhaps impossible.

Therefore, it is useful to point out the LENR studies of the nickel-hydrogen system: raw materials that are far less expensive than palladium and heavy water and, hence, more likely to be considered as the materials on which to run a true hydrogen economy.

Considering the accelerating energy crisis, growing worldwide demands for increased energy, and geopolitical instabilities that are largely to do with energy resources, the possibilities suggested by LENR come at an ideal time. We are beginning to see this historic science development find inclusion as a research topic in university chemistry and physics settings worldwide. Although the promises of the field remain tentative, the interest in this exciting new field is nevertheless being received enthusiastically.

LENR does not appear to fit into current scientific understanding, and it raises uncomfortable questions about current and historical understandings of nuclear physics. The path forward will require new openness, receptivity and tolerance. It may require flexibility on the part of orthodox physicists to learn from LENR researchers. It may also require LENR researchers to learn from orthodox physics. Together, the disciplines of chemistry and physics are building and will continue to build the foundation of a new field of science.

LENR excess heat and transmutations may require science to throw away older conventions in order to make a new start based on a different fundamental perspective. On the other hand, perhaps a new perspective from conventional physics will arrive that will encompass the new knowledge of LENR without the abandonment of time-tested principles of science.

This book is a starting place that outlines fundamental aspects of a new science that may help us to provide solutions to make a more liveable world in the course of this century.

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