Cold Fusion

Clean Energy for the Future

Talbot A. Chubb

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Dedicated to Yoshiaki Arata and Yue-Chang Zhang.

Professor Arata recently wrote the following in reference to his cold fusion studies using nanometer palladium.

> "D_2 gas instantly penetrate into the specimen and D atoms change into **^{4}He** instantly (no need time) and nuclear Fusion (**^{4}He** and energy) is established perfectly under the following equation:
>
> **$^2D + {}^2D = {}^4He$ + thermal energy**
>
> .....
>
> It is considered that this phenomena is the highest result in this century."

Preface

This book has been made possible by the scientists, supporters, and organizers who have kept cold fusion alive for nearly two decades, and their families who have sacrificed so much in this effort. I want to thank those who have expended their careers in this task. I want to thank those who have been my teachers, both in person, and in their papers and text books. I want to especially thank Fleischmann and Pons, who discovered cold fusion, Arata and Zhang, who pioneered nanometal cold fusion, and Scott Chubb, who has been my main teacher in metal physics and many-body theory. I want to thank those who have remained largely anonymous while helping in the thankless effort of keeping cold fusion alive.

The author wishes to thank Pete McQuillin for advice and help in planning this book, Constance Chubb and Scott Chubb for help with the figures used in the manuscript, Mike Melich for help with the Supplements, and Xing Zhong Li, James Kurfess, and Marianne Macy for providing editorial input and calling my attention to errors and deficiencies in my writing.

Opportunity Knocks

This book tells the story of cold fusion. We have a serious energy and environment problem. We also have an economic and social problem. We seek a healthy, happy society in which medical problems are addressed, needy older people are cared for, and children are educated to love learning and enjoy fellowship. The solutions to these social problems are labor intensive, yet need to be addressed without imposing excessive economic insecurity on the recipients. But we should not be discouraged. There are new technologies available to help us meet these needs. Cold fusion is one such technology. It can be a big help along the way to a better and more exciting world.

Opportunity knocks. On the one hand, the price of oil has reached $90 per barrel, and the cost of gasoline exceeds $3.00 per gallon. The level of carbon dioxide in the atmosphere increases every year. World temperatures have risen over the past decade, and there are worries about a potential rise in sea level. Loss of habitat threatens animal and plant diversity. On the other hand, science and technology advances have made it possible to add an essentially limitless fuel supply to our menu of available energy sources. This new energy source provides 10 million times the energy per pound of oil and gas. The new energy fuel is the heavy hydrogen component of water, including sea water. The fuel is available to all nations. This new energy is radiationless cold fusion. Cold fusion is a new form of nuclear energy that avoids all the worries associated with today's nuclear power plants. It does not use uranium. It has no atom bomb potential, hence its use can greatly reduce the possibility of atom bomb proliferation, leading to a more secure world. It avoids the radioactive waste products of nuclear power plants, which eliminates the waste storage problem and worries about contamination of the land. Its energy production does not require large centralized power plants. It can be used for off-grid home heating and generation of household electricity. The radiationless cold fusion process is a catalytic process involving a metal solid.

The main goal of this book is to make the reader aware of recent laboratory studies that show that cold fusion is real and that it can likely produce commercial power within a few years, assuming that a modest research effort is supported.

The book starts with examining how cold fusion relates to ordinary chemistry and physics. Next comes a discussion of various forms of atomic power, followed by a discussion on quantum mechanics, followed by a brief history of cold fusion research beginning with the discovery announcement by Drs. Martin Fleischmann and Stanley

Pons. The final part discusses the quantum mechanics of chemical orbitals, their relation to electron quasiparticles in metals, and how heavy hydrogen quasiparticles can undergo fusion.

Clean energy fusion began with the discovery of radiationless cold fusion, announced in 1989. The discovery stimulated great controversy. The early development history was filled with conflicting claims and experiment failures. The physics community decided that an error had been made, and research funding faded away. The workers who persisted in their studies organized a series of International Conferences on Cold Fusion. Studies reported on were published in a series of Proceedings publications now known as *Proc. ICCF1* through *Proc. ICCF13.* Other papers were published in standard journals.

To reduce controversy, different names have been used to describe the radiationless cold fusion process. One of the names is Low Energy Nuclear Reactions (LENR), which led to the LENR.org website. Another name is Chemical Induced Nuclear Reactions (CANR), which led to the LENR-CANR.org website. A professional society was incorporated under the name International Society for Condensed Matter Nuclear Science (ISCMNS). Osaka University physicists Arata and Zhang, who have carried out pivotal cold fusion studies using nanometals, prefer the name "Solid Fusion", and have also used the name "Solid State Fusion".

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