



Karl Kordesch, PhD

Chemist, Inventor, Professor

Known as the Father of the Copper-Top Battery, Dr. Karl Kordesch is honored with many published biographies and articles. The following information was gleaned from two such sources, both credited below.

In May 2009 Global Energy Systems of Oregon was privileged to have Dr. Kordesch visit their research laboratory to verify the efficiency of the GES hydrogen production system, which he stated was "the best he had ever seen". He was a fine scientist and a great friend, and the engineers at GES are saddened by his passing.

Biography of Karl Kordesch

Dr. Karl Kordesch has been in the fuel cell and battery business all his life and has 150 patents in his name. He has written a number of books and published hundreds of technical papers on fuel cells and batteries. He invented the Alkaline Primary Battery Cell for flashlight batteries which replaced the Zinc-Carbon cells. This battery is now sold by Eveready, Energizer, Duracell and Rayovac which have 75% of the market in the USA. Karl Kordesch studied chemistry and physics at the University of Vienna, Austria, and received his Doctorate from that university in 1948.

From 1953 to 1955 he was a Scientific Staff member of the U.S. Signal Corp., Fort Monmouth, and managed its battery section which resulted in several patents assigned to the U.S. Government. From 1955 to 1977, he worked for Union Carbide Corporation. He started out as a Scientist, Group Leader, then Department Head and finally Corporate Research Fellow in the fields of batteries and fuel cells. He was granted 60 patents in batteries and electrochemical systems, all assigned to Union Carbide.

Patents of Karl Kordesch

The present invention is useful not only in fuel cells employing gaseous fuels such as hydrogen, but also in cells utilizing liquid fuels such as alcohols.

Since such organic liquids tend to leak across the electrolyte and attack the wet-proofing on the cathode, the operation of such a cell is substantially improved by using the subject separator-reservoir member to prevent such cross-leakage. This particular feature is useful in cells in which useful chemical products are produced as well as electrical power; the chemical products formed at the cathode and anode can be physically separated and removed without contamination.

Karl Kordesch invented the Alkaline Primary Battery Cell which replaced the Zinc-Carbon flashlight batteries. Eveready, Energizer, Duracell and Rayovac now have 75% of the Alkaline Primary Cell market in the U.S.A. He developed Hydrazine and Alkaline Fuel Cells in cooperation with the U.S. Army, U.S. Navy and NASA. In 1966 he developed a new, thin carbon electrode and, based on this, his group built a 150 kW Alkaline Fuel Cell for the General Motors "Electrovan", and a 90 kW Alkaline Fuel Cell for the Ford Motor Company.

Union Carbide also experimented with alkali cells in the late 1950s and 1960s. Building on the work done in the 1930s by researchers G. W. Heise and E. A. Schumacher, Karl Kordesch and his colleagues designed alkali cells with carbon gas-diffusion electrodes. They demonstrated a fuel-cell-powered mobile radar set for the U.S. Army, a fuel-cell-powered motorbike, and drew up plans for an undersea base that would run on fuel cells. About the same time, Eduard Justi of Germany designed gas-diffusion electrodes using nickel sponge on a carbonyl nickel matrix.

Alkaline or Alkaline Manganese Dioxide cells, have many advantages over zinc-carbon cells including higher energy output. Other significant advantages are longer shelf life, better leakage resistance, and superior low temperature performance. In comparison to the zinc-carbon cell, the alkaline cell delivers up to ten times the ampere-hour capacity at high and continuous drain conditions, with its performance at low temperatures also being superior to other conventional aqueous electrolyte primary cells. Its more effective, secure seal provides excellent resistance to leakage and corrosion.

The most popular primary batteries are alkalines. Based on manganese dioxide, zinc and a caustic potassium hydroxide-zinc oxide electrolyte, alkaline-cell technology offers greater capacity for a given cell size compared with Leclanche types, but they cost more and weigh about 25 percent more. There have been major improvements in alkaline cell performance over the decades.

These improvements have been a result of changes in packaging and manufacturing techniques rather than any improvements to the basic chemical system. In the past, alkaline batteries were made with complex sealing systems and thick steel outer cases and end caps. During the 1980s, a method was developed that allowed manufacturers to use thinner packaging materials and more efficient seals. More room was created for active materials within a given standard cell size, and that increased capacity.

The fuel-cell-powered motorbike looks like an ordinary motorbike but there's no internal combustion engine and there's no noise. The machine, which is powered by a hydrazine-airfuel cell system, was built under the direction of Union Carbide's Dr. Karl Kordesch, a pioneer in fuel cell development. Dr. Kordesch has run up over 300 miles on the motorbike which can do 25 miles an hour and can travel 200 miles on a gallon of hydrazine.

In 1970 Dr. Karl Kordesch built an Alkaline Fuel Cell/Battery Hybrid Electric Car based on an A-40 Austin and drove it for his own personal transportation needs for over three years. The Fuel Cell was installed in the trunk of the car and hydrogen tanks on the roof, leaving room for 4-passengers in the 4-door car. It had a driving range of 180 miles (300 km). Thus, he was the first person in the world to have produced and driven a practical Fuel Cell/Battery Electric Car.

Dr. Karl Kordesch also started at Union Carbide development of a rechargeable alkaline flashlight battery which was later marketed under the Eveready brand.

In 1977 he took early retirement from Union Carbide and was offered the position as Full Professor to the chairs of Electrochemistry at the Technical University Vienna, Austria, or Head of the Institute of Inorganic Technology and Analytic Chemistry at the Technical University of Graz in Austria. He accepted the latter position and remained as Director of the Institute until 1992. He now serves as Professor Emeritus with that Institute with an office, laboratory and staff at his disposal.

While Director of the Institute at the Technical University of Graz, he directed work on electrochemical systems under contracts with Varta Batteries in Germany and other European battery manufacturers. He also headed the Austrian Government Scientific Program, managing a 1984-89 joint five-year program with eight different participating Austrian Universities and Industrial Groups covering Fuel Cell Systems, Zinc-Bromine Batteries, Bipolar Batteries, Catalysts, Environmental Studies, among others.

From 1981 to 1985 he served as Secretary General of the International Society for Electrochemistry (ISE) and is a member of several other scientific and technical societies. In 1986, he received the Technology Award of the U.S.-Electrochemical Society (Vittorio De Nora Gold Medal). In 1990 he received the Austria State Energy Prize and the Ernst Schroedinger Prize. In 1991 he was awarded the Frank M. Booth Prize of the Royal Society of Great Britain. In 1992 he was awarded the Auer V. Welsbach Medal.

In 1986 he was a co-founder of Batteries Technologies Incorporated (BTI) in Toronto, Canada and became the Senior Vice President of Research & Development. Twenty (20) patents were granted to him and assigned to BTI on Rechargeable Alkaline Manganese Dioxide (RAM) Batteries (small batteries for flashlights and small appliances, not competitive with AES's Lead Cobalt Batteries). BTI has licensees in the U.S.A. (RAYOVAC), in Korea (YOUNG POONG), Malaysia and Austria (GRAND BATTERY INC [GBY]), and in Germany (BATTERY INNOVATION GROUP [BIG]).

In 1988, he formed Kordesch & Associates, Inc. and acts as a consulting company in Canada, serving BTI and others. Between 1988 and 1993, he participated in the European Space Agency (ESA) Program developing an Alkaline Matrix Fuel Cell for the manned Space Vehicles HERMES under contracts between the Technical University of Graz, Dornier and Siemens.

In 1990 he received an Honorary Doctorate of the Technical University of Vienna. He wrote several books on batteries, electric vehicles and fuel cells, the latest being Fuel Cells and their Application published by Verlagsgesellschaft mbH (VCH) in Germany, Switzerland, UK, USA, Canada and Japan in 1996, and has written over 200 technical publications.

In 1997, in cooperation with Energy Ventures Inc. (EVI) of Canada, he managed a development program for the National Research Council, Ottawa, Canada, covering rechargeable Nickel-Zinc and Zinc-Carbon Batteries with Austria Government participation. He is head of research of EVI. In 1997 he joined Apollo Energy Systems, Inc. as Vice President in charge of fuel cell development.

The Apollo Fuel Cell is an alkaline fuel cell with circulating electrolyte first developed in the 1960s by Dr. Karl Kordesch. It has been improved continuously since then, with final improvements being made at the Technical University of Graz, Austria (TU Graz). It is the least expensive of all fuel cell types, and unlike other types, can be shut down when not in operation, thus improving the life of the electrodes and improving safety. The Apollo™ Fuel Cell

represents a considerable improvement over Dr. Kordesch's previous fuel cells. The new electrodes develop over 100% more power than the previous ones.

In addition, a new ammonia-based "Propulsion Fuel" has been developed together with an Ammonia Cracker. This Propulsion Fuel is fed into the Cracker which then breaks down the ammonia (NH₃) into hydrogen for the fuel cell and harmless nitrogen (normal air contains approximately 78% nitrogen and 21% oxygen). The Company believes that this is the best way to produce hydrogen for a fuel cell. Ammonia is produced throughout the world in large volume, around 100,000 tons a year, and is used for agriculture and refrigeration. It is estimated that over 50% of the refrigerators in Europe operate on ammonia.

On March 22, 2002, Dr. Karl Kordesch celebrated his 80th birthday. He is still active 12-hours a day in activities such as:

Technology transfer of Apollo Fuel Cell Program from the Technical University of Graz in Austria (TUG) to Fort Lauderdale, Florida. The Program was started in 1997 and completed near the end of 2001.

Further development of MARS Fuel Cell, a Direct Methanol Alkaline Fuel Cell that eliminates Reformers or Crackers. Methanol is injected directly into the MARS Fuel Cell to produce hydrogen. This type of fuel cell can be miniaturized for use in small appliances such as cell phones, or can be made in large kilowatt sizes for homes and vehicles.

<http://profiles.incredible-people.com/karl-kordesch/>

Karl Kordesch

From Wikipedia, the free encyclopedia

Karl Kordesch (18 March 1922 – 12 January 2011) was an Austrian chemist and inventor, most notable for jointly inventing the alkaline battery.

Life

Kordesch was born in Vienna. He studied chemistry and physics at the University of Vienna, and earned his doctoral degree in 1948. From 1948–53 he worked at the university's Chemical Institute. He was then recruited as a member of Operation Paperclip and moved to the United States, where from 1953–55 he was head of the Battery Division of the U.S. Signal Corps in Fort Monmouth. In 1955 he joined Union Carbide in Ohio, working with two fellow Austrians. He led two research groups: one concerned with the development of manganese dioxide batteries, the other devoted to fuel cells. During this time Kordesch filed 22 patents.

In 1957, Karl Kordesch, Paul A. Marsal and Lewis Urry filed US patent (2,960,558) for the alkaline dry cell battery, which eventually became the D-sized Eveready Energizer battery. It was granted in 1960.

Another fundamental contribution that changed the battery world was the creation of the thin carbon fuel cell electrode. He presented a fuel cell demonstration at the Brussels World Fair in

1958, using a suitcase with a hydrogen-oxygen fuel cell. His development of thin electrodes for fuel cells came soon thereafter.

In 1967 he built a fuel cell/NiCad battery hybrid electric motorcycle. The motorcycle was featured in television commercials for the program *21st Century*, hosted by Walter Cronkite. He relished telling people how he had to join the actors' union to ride in the commercials. It was fitted with a hydrazine fuel cell, capable of 200 miles to the U.S. gallon.

In 1970 he fitted his own Austin A40 with a hydrogen fuel cell (ammonia being too hard to come by), and used the adapted vehicle as his personal transportation for over three years. The vehicle retained enough room inside for four passengers and had a driving range of 180 miles. His fuel cell design provided the basis for the 40 kWh alkaline hydrogen-oxygen fuel cell for the General Motors Electrovan.

In 1977 he was granted early retirement by Union Carbide and returned to Austria, becoming director of the Institute for Inorganic Technology at the Graz University of Technology (TU Graz). From 1981–83 Kordesch was general secretary of the International Society of Electrochemistry (ISE). From 1985–87 he was Dean of the Science and Technology Faculty at TU Graz; in 1992 he became emeritus.

In 1997 he became vice-president of Apollo Energy Systems, and was tasked with the continued development of fuel cells. His research continued at TU Graz on fuel cell electrode performance, low-cost fuel cell stack design, propulsion fuel (NH₃), and an ammonia cracker. He was gratified to see the electric car and the hybrid-electric make a comeback in his last years. He was 40 years early with the electric hybrid vehicles that he enjoyed building and driving.

In total he filed 120 patents, as well as producing numerous books and over 200 publications, all on the topic of batteries and fuel cells.

He died in Eugene, Oregon, in 2011.

Selected works

- *Einsatz der Brennstoffzellentechnologie für die dezentrale Energienutzung II*, 1999, with Günter Simader (**German**)
- *Fuel Cells and Their Applications*, with Günter Simader, 2007, ISBN 3-527-29777-4
- *Batteries: Volume 1 – Manganese Dioxide*, New York, 1974, ISBN 0-8247-6084-0

Distinctions

- 1967 Wilhelm Exner Medal
- 1986 Technology Award (Vittorio de Nora Award) of the U.S. Electrochemical Society
- 1990 Erwin Schrödinger Prize of the Austrian Academy of Sciences
- 1990 Honorary doctorate from the Vienna University of Technology
- 1992 Auer v. Welsbach Medal of the Society of Austrian Chemists
- 1992 Gold award from the state of Styria, Austria (*Großes Goldenes Ehrenzeichen des Landes Steiermark*)

http://en.wikipedia.org/wiki/Karl_Kordesch