



Infinite Power Solutions®

PRESS RELEASE

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INFINITE POWER SOLUTIONS GRANTED THREE KEY UNITED STATES PATENTS

Patents Protect Key Methods for Manufacturing Solid-State Thin-Film Batteries

Littleton, Colo., September 27, 2011—Infinite Power Solutions, Inc. (IPS), a U.S. clean-technology company and global leader in manufacturing solid-state, rechargeable batteries, today announced that the United States Patent and Trademark Office (USPTO) has recently granted them three key manufacturing and technology patents. The three patents, U.S. Pat. No. 7,959,769 entitled, "Deposition of LiCoO₂," U.S. Pat. No. 7,993,773 and U.S. Pat. No. 8,021,778, both entitled, "Electrochemical Apparatus with Barrier Layer Protected Substrate," represent major technology achievements in the field of solid-state thin-film battery manufacturing, and provide a significant competitive advantage for the company.

In part, U.S. Pat. No. 7,959,769 protects IPS' method of depositing Lithium Cobalt Oxide (LiCoO₂) films inside of a Physical Vapor Deposition (PVD) sputter system. Essentially, the patent protects the method of using Pulsed-DC power applied to the sputter target, followed by a rapid thermal annealing process step at less than 700°C for less than 10 minutes. Experts in this field consider Pulsed-DC to be the "holy-grail," as it is the most efficient method for depositing LiCoO₂ cathode films. Other methods, such as RF sputtering, are much more complicated, substantially more cost-intensive, and provide significantly inferior performance in conjunction with the patented low thermal budget. Furthermore, and as a result of the effectiveness of the lower thermal budget, this patent also protects the use of a variety of substrates, namely silicon, polymers, glasses, ceramics, stainless steel and other metals, in conjunction with the above described deposition method.

With this Pulsed-DC method, it is substantially easier and less expensive to produce high performance LiCoO₂ films than by conventional RF sputter methods used today. RF magnetron sputtering of LiCoO₂ films using a much longer and necessary post-deposition anneal process was invented at Oak Ridge National Laboratories (ORNL) in 1995, and has been the standard LiCoO₂

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fabrication method used globally ever since. The Pulsed-DC method is particularly important for large scale manufacturing, from mid-size machines (e.g. Gen 3 - Gen 5) to the largest PVD deposition machines (e.g. Gen 10).

The patented low thermal budget requirement of less than ~700°C and less than ~10 minutes for optimized LiCoO₂ films allows IPS to use a variety of substrate materials, as mentioned above. Many of these temperature sensitive substrate materials could not be used in the past due to a long post-deposition thermal treatment at high temperatures. Such thermal treatments were greater than 700°C for substantially longer than 10 minutes, which either damaged the substrates or created adverse reactions between the substrates and the battery materials.

The patent for Pulsed-DC deposition of LiCoO₂ also includes a preferred method for two other recently granted patents to IPS, U.S. Pat. No. 7,993,773 and U.S. Pat. No. 8,021,778, both entitled, "Electrochemical Apparatus with Barrier Layer Protected Substrate." These device patents essentially protect electrochemical cells on metallic, polymeric, doped or un-doped silicon substrates that have electrochemical cells deposited on either one or both substrate surfaces wherein these cells are separated from the substrate by a specific barrier layer. This specific barrier layer is composed of sub-layer materials that are electrically conducting or semiconducting. Most importantly, the barrier layer provides chemical separation of all of the battery materials from the substrate throughout the entire manufacturing process, and also in the completed battery. The specific properties of the barrier layer allow the substrate to serve as one of the battery's terminals, which substantially simplifies the fully packaged battery and reduces the number of deposition layers, materials, and resulting manufacturing costs to create these batteries.

Dr. Bernd Neudecker, Chief Technology Officer at IPS, commented, "Pulsed-DC sputter deposition, in conjunction with rapid thermal anneal at limited temperatures, is clearly the most efficient and best known method for the fabrication of high quality LiCoO₂ films. We are excited to have the USPTO recognize the significance of the method we have developed and grant this key patent." In addition, he stated, "This is just one of many unique manufacturing methods we are using to increase the performance, reliability, longevity and safety of our advanced batteries to meet the needs of our customers. We are also very pleased with issuance of the two barrier layer patents that form the basis for our high performance thin-film batteries fabricated on a metal foil substrate."

In addition to the recent U.S. patent grants, IPS anticipates that all three patents will soon be granted in Europe, Japan, Korea, China, and Taiwan where they are presently in the final stages of prosecution. IPS currently employs this advanced Pulsed-DC and barrier layer fabrication method, in addition to other patents and substantial trade secrets, to fabricate its award-winning THINERGY® Micro-Energy Cell (MEC) products in a high volume ISO 9001 certified battery production facility in Littleton, Colo. THINERGY MECs are recognized by many to be the highest performance solid-state, rechargeable, thin-film batteries available today.

About Infinite Power Solutions (www.InfinitePowerSolutions.com)

Infinite Power Solutions, Inc. (IPS)—a U.S. clean-technology company—is a global leader in manufacturing solid-state, rechargeable, thin-film micro-energy storage devices. Founded in 2001, IPS is privately held with corporate headquarters and volume manufacturing in Littleton, Colo. The company is the only ISO 9001 certified manufacturer of all-solid-state, thin-film batteries and its energy storage products provide unrivalled performance, size and service life to displace conventional coin cells, supercapacitors, and other printed and solid-state micro-batteries in a variety of applications. THINERGY® Micro-Energy Cell (MEC) products are paper-thin and provide unprecedented efficiency in micro-energy storage and uniquely enable embedded power and ambient energy-harvesting solutions to create miniature, autonomous, perpetual power supply solutions.

THINERGY and MEC are registered trademarks of IPS.

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