State of the Art Batteries for Implantable Medical Devices

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The year 2002 marks the 30th anniversary of the first implant of a pacemaker powered by a lithium battery.[1] Thirty years later, lithium-based batteries remain at the forefront of power source technology for implantable medical devices, with many recent developments in the specialized chemistries for these applications.

Early pacemakers used zinc/mercury cells, but by the early 1970's it was clear that an alternate power source was needed. With the implantation of the first lithium battery (a lithium/iodine cell inside a pacemaker) in 1972, the era of advanced lithium batteries for implantable medical devices was born. Improved versions of the Li/I_2 battery are still used today, for nearly all pacemakers implanted worldwide.

Recent advances in pacemaker technology and the type of therapy that can be provided have placed increasing demands on the current capability of the power source. In response, advanced lithium/carbon monofluoride batteries have been developed for new pacemaker applications.[2]

Implantable cardioverter-defibrillators (ICDs) are devices that detect and provide therapy for a range of ventricular tachyarrhythmias. The thrust of this therapy is to provide a shock directly to the patient's heart, stopping ventricular fibrillation. Thus, the power source for this application must be able to provide very high current pulses on demand, in addition to meeting other special requirements for the implantable device. Development of lithium/silver vanadium oxide batteries for this application led to the successful commercialization of this life-saving device.[3]

Many new implantable medical devices are currently under development.[4] These include neurostimulators to treat diseases such as Parkinson's disease and epilepsy, implantable hearing devices to treat hearing loss which can not be treated by conventional hearing aids, and devices to assist the heart in pumping blood (LVADs) or replace the heart entirely (artificial hearts). These new devices all have specific requirements which require new power source solutions. These include advanced rechargeable battery chemistries to enable high power output over many years of service for the implanted device.[5]

References

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