B3 BATTERIES

TYPES OF BATTERY

CHEMICAL INDUSTRIES
RESOURCE PACK

Introduction

Electrical energy plays an important role in our daily life. It can be universally applied and easily converted into light, heat or mechanical energy. A general problem, however, is that electrical energy can hardly be stored. Capacitors allow its direct storage, but the quantities are small compared to the demand of most applications. In general, the storage of electrical energy requires its conversion into another form of energy. In batteries the energy of chemical compounds acts as storage medium and during discharge a chemical process occurs that generates energy which can be drawn from the battery in the form of an electric current at a certain voltage. For a number of battery systems this process can be reversed and the battery recharged. In other words, the intake of electric energy can restore the chemical composition that contains higher energy and can closely re-establish the original structures within the battery.

As a consequence, two different battery systems exist: Primary batteries that are designed to convert their chemical energy into electrical energy only once, and secondary batteries are reversible energy converters and designed for repeated discharges and charges. They are genuine electrochemical storage systems.

There is no clear border between them, and some primary battery systems permit charging under certain conditions. Usually, however, the extent to which primary batteries can be recharged is limited. Batteries of larger capacities are employed as standby batteries in stationary applications, and provide energy in vehicles like forklift trucks, or stabilise an electrical network like the starter battery in motor cars. Rechargeable batteries usually are the choice in such applications, since primary batteries would be too expensive for the required rather high capacity. Batteries in portable applications have smaller capacities. In this field primary as well as secondary batteries are used.

This material was obtained from the Battery Technology Handbook. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Kiehne, H. A. (Ed.) 2003. Battery Technology Handbook - Second Edition. Marcel Dekker Inc. New York.

New technology - rechargeable Batteries

22 February 2010

Until recently, rechargeable batteries would lose their charge quicker than non-rechargeable batteries. If a rechargeable was used in low-power appliances, such as a kitchen wall-clock, it would discharge quicker than a non-rechargeable battery. This gave little incentive to purchase rechargeable batteries for low power consumption appliances, because they would lose their power in weeks rather than months. Now, based on a new bio-degradable chemical technology, the Uniross Hybrio range of rechargeable batteries will lose only 20% of their charge in a year. This makes the Hybrio suitable for all types of appliances, while still ideally suited to high-power consumption devices such as digital and video cameras.

Source: This article was published online by Creamer Media's Engineering News. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Engineering News. 2010. New technology - rechargeable batteries. [Online]. Available: www.EngineeringNews.co.za [27 July 2010].

DID YOU KNOW?

The basic element of each battery is the cell. The term 'battery' generally refers to several cells being connected in series or in parallel, but in everyday language single cells are also called 'batteries'; for example the 'battery' used in a torch light.

WHAT IS ENERGY DENSITY?

Energy density is the ratio of a battery's energy-delivery capability to its mass. It is measured in watt-hours per kilogram ($Wh \cdot kg^{-1}$).

Will secondary batteries replace primaries?

Consumer market aside, the largest users of primary (non-rechargeable) batteries are the military, specialty emergency services and forest fire fighters. High energy density, long storage and operational readiness are among their strong attributes. No charging and priming is required before use. Logistics are simple and battery power can be made available at remote locations that are unmanned and have no electrical power. Disposal is easy because most primary cells contain little toxic materials.

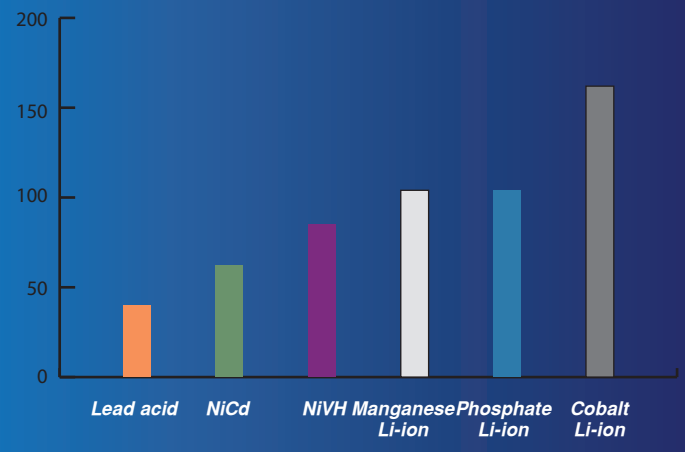
Primary batteries have the highest energy density. Although the secondary (rechargeable) batteries have improved, a regular household alkaline provides 50% more power than lithium-ion, one of the highest energy-dense secondary batteries. The primary lithium battery used in cameras holds more than three times the energy of a lithium-ion battery of the same size. A disadvantage of primary batteries is their relative high internal resistance, which inhibits current flow. High internal resistance has little effect when powering low-current devices such as a television remote control or a kitchen clock. The problem arises with digital cameras and other power-hungry devices. A power drain on an alkaline battery would be unthinkable. The voltage would cause collapse. We now take the same batteries and run them under a load. The purple bars in the bottom graph on the right represent the usable energy if the batteries were used in a device such as a digital camera.

The advantage of secondary batteries therefore is low internal resistance. This allows high current on demand, a property that is essential for digital devices and instruments needing high inrush currents. Power tools, for example, could not be run effectively on alkaline batteries. However, rechargeable batteries have their limitations. Beside marginal energy density, secondary batteries have a defined shelf life and lose the ability to hold charge as they age. Secondary batteries have a limited cycle count. The number of cycles achieved is based on the depth of discharge, environmental conditions, charge methods and maintenance procedures. Each type of battery behaves differently in terms of aging and wear.

A comparison between different types of battery

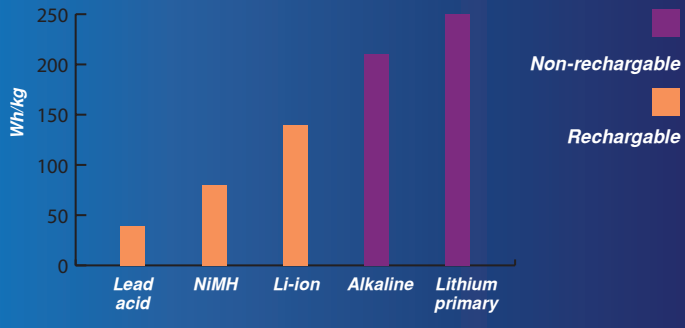
Type	Voltage	Rechargeable?
Dry cell	1,5	No
Alkaline	1,54	No
Mercury	1,3	No
Lithium-iodine	2,8	No
Lead storage	2,0	Yes
Nickel-cadmium	1,46	Yes

This material was obtained from BatteryUniversity.com. Learners - if you use any part of it you need to write it in your own words and include the following in your reference list: Buchmann, I. 2005. Batteryuniversity.com - What's the best battery for wheeled and stationary applications? [Online]. Available: www.batteryuniversity.com/parttwo-40.htm. [27 July 2010].



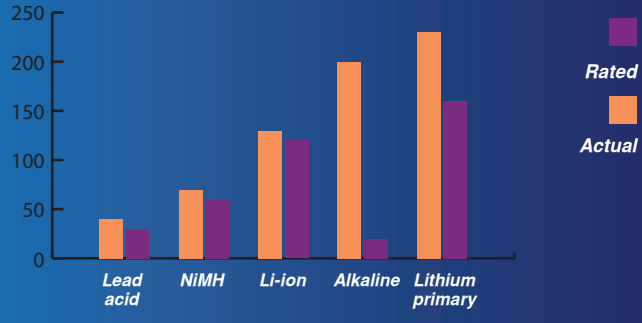
Energy densities of common battery chemistries: Lithium-cobalt enjoys the highest energy density. Manganese and phosphate systems are thermally more stable and deliver higher load currents than cobalt.

Source: BatteryUniversity.com



Energy comparison of rechargeable and non-rechargeable batteries

Source: BatteryUniversity.com



Energy comparison under load. The alkaline works well for a kitchen clock but fails on a digital camera.

Source: BatteryUniversity.com

DID YOU KNOW?

An ampere-hour or amp-hour (symbol Ah or A·h) is a unit of electric charge. One ampere-hour is equal to 3 600 coulombs (ampere-seconds), the electric charge transferred by a steady current of one ampere for one hour. The unit of milliampere-hour (mAh or mA·h) is often used. This refers to one-thousandth of an ampere-hour, or 3,6 coulombs.