Will the Reusable Alkaline Battery have a Future?

The reusable alkaline was introduced in 1992 as an alternative to disposable batteries. The battery was promoted as a low-cost power source for consumer goods. Attempts were made to open markets for wireless communications, medical and defense. But the big breakthrough never came. Today, the reusable alkaline occupies only a small market and its use is limited to portable entertainment devices and flashlights. The lack of market appeal is regrettable when considering the environmental benefit of having to discard fewer batteries. It is said that the manufacturing cost of the reusable alkaline is only marginally higher than the primary cell.

The idea of recharging alkaline batteries is not new. Although not endorsed by manufacturers, ordinary alkaline batteries have been recharged in households for many years. Recharging these batteries is only effective, however, if the cells have been discharged to less than 50% of their total capacity. The number of recharges depends solely on the depth of discharge and is limited to a few cycles at best. With each recharge, the amount of capacity the cell can hold is reduced. There is a cautionary advisory. Charging ordinary alkaline batteries may generate hydrogen gas, which can lead to explosion. It is not prudent to charge ordinary alkaline unsupervised.

The reusable alkaline is designed for repeated recharge. Also here,, there is a loss of charge acceptance with each recharge. The longevity of the reusable alkaline is a direct function of the depth of discharge; the deeper the discharge, the fewer cycles the battery can endure.

Tests performed by Cadex on 'AA' reusable alkaline cells showed a high capacity reading on the first discharge. In fact, the energy density was similar to that of nickel-metal-hydride. After the battery was fully discharged and recharged using the manufacturer's charger, the reusable alkaline settled at 60%, a capacity slightly below that of nickel-cadmium. Repeat cycling in the same manner resulted in a fractional capacity loss with each cycle. The discharge current in the tests was adjusted to 200mA (0.2 C-rate, or one fifth of the rated capacity); the end-of-discharge threshold was set to 1V/cell.

An additional limitation of the reusable alkaline system is its high internal resistance, resulting in a load current capability of only 400mA (lower than 400mA provides better results). Although adequate for portable radios receivers, CD players, tape players and flashlights, 400mA is insufficient to power most mobile phones and video cameras.

The reusable alkaline is inexpensive to buy but the cost per cycle is high when compared to other rechargeable batteries. Whereas nickel-cadmium checks in at $0.04US per cycle based on 1500 cycles, the reusable alkaline costs $0.50 based on 10 full discharge cycles. For many applications, this seemingly high cost is still economical when compared to primary alkaline that provides a one-time use. By only partially discharging the reusable alkaline, an improved cycle life is possible. At 50% depth of discharge, 50 cycles can be expected.

To compare the operating cost between the standard and reusable alkaline, a study was done on flashlight batteries for hospital use. The reusable alkaline achieved measurable cost savings in the low?intensity care unit in which the flashlights were used only occasionally. The high-intensity care unit, which used the flashlights constantly, did not attain the same result.

Deeper discharge and more frequent recharge reduced the service life and offset any cost advantage over the standard alkaline battery.

When considering reusable alkaline, one must realize that the initial energy is slightly lower than that of the standard alkaline. Each subsequent recharge/charge cycle causes the capacity to decrease. Cost savings are realized if the batteries are never fully discharged but have a change to be recharged often.