Battery University

BU-203: Nickel-based Batteries

Learn about the differences in nickel-cadmium and nickel-metal-hydride.

For 50 years, portable devices relied almost exclusively on nickel-cadmium (NiCd). This generated a large amount of data, but in the 1990s, nickel-metal-hydride (NiMH) took over the reign to solve the toxicity problem of the otherwise robust NiCd. Many of the characteristics of NiCd were transferred to the NiMH camp, offering a quasi-replacement as these two systems are similar. Because of environmental regulations, NiCd is limited to specialty applications today.

Nickel-cadmium (NiCd)

Invented by Waldemar Jungner in 1899, the nickel-cadmium battery offered several advantages over lead acid, then the only other rechargeable battery; however, the materials for NiCd were expensive. Developments were slow, but in 1932, advancements were made to deposit the active materials inside a porous nickel-plated electrode. Further improvements occurred in 1947 by absorbing the gases generated during charge, which led to the modern sealed NiCd battery.

For many years, NiCd was the preferred battery choice for two-way radios, emergency medical equipment, professional video cameras and power tools. In the late 1980s, the ultra-high capacity NiCd rocked the world with capacities that were up to 60 percent higher than the standard NiCd. Packing more active material into the cell achieved this, but the gain was shadowed by higher internal resistance and reduced cycle count.

The standard NiCd remains one of the most rugged and forgiving batteries, and the airline industry stays true to this system, but it needs proper care to attain longevity. NiCd, and in part also NiMH, have memory effect that causes a loss of capacity if not given a periodic full discharge cycle. The battery appears to remember the previous energy delivered and once a routine has been established, it does not want to give more. (See BU-807: How to Restore Nickel-based Batteries) According to RWTH, Aachen, Germany (2018), the cost of NiCd is about $400 per kWh. Table 1 lists the advantages and limitations of the standard NiCd.

Advantages	Rugged, high cycle count with proper maintenance Only battery that can be ultra-fast charged with little stress Good load performance; forgiving if abused Long shelf life; can be stored in a discharged state, needs priming before use Simple storage and transportation; not subject to regulatory control Good low-temperature performance Economically priced; NiCd is the lowest in terms of cost per cycle

	Available in a wide range of sizes and performance options
Limitations	Relatively low specific energy compared with newer systems Memory effect; needs periodic full discharges and can be rejuvenated Cadmium is a toxic metal. Cannot be disposed of in landfills High self-discharge; needs recharging after storage Low cell voltage of 1.20V requires many cells to achieve high voltage

Table 1: Advantages and limitations of NiCd batteries.

Nickel-metal-hydride (NiMH)

Research on nickel-metal-hydride started in 1967; however, instabilities with the metal-hydride led to the development of the nickel-hydrogen (NiH) instead. New hydride alloys discovered in the 1980s eventually improved the stability issues and today NiMH provides 40 percent higher specific energy than the standard NiCd.

Nickel-metal-hydride is not without drawbacks. The battery is more delicate and trickier to charge than NiCd. With 20 percent self-discharge in the first 24 hours after charge and 10 percent per month thereafter, NiMH ranks among the highest in the class. Modifying the hydride materials lowers the self-discharge and reduces corrosion of the alloy, but this decreases the specific energy. Batteries for the electric powertrain make use of this modification to achieve the needed robustness and long life span.

Consumer Applications

NiMH has become one of the most readily available rechargeable batteries for consumer use. Battery manufacturers, such as Panasonic, Energizer, Duracell and Rayovac, have recognized the need for a durable and low-cost rechargeable battery and offer NiMH in AA, AAA and other sizes. The battery manufacturers want to lure buyers away from disposable alkaline to rechargeable batteries.

The NiMH battery for the consumer market is an alternative for the failed reusable alkaline that appeared in the 1990s. Limited cycle life and poor loading characteristics hindered its success.

Table 2 compares the specific energy, voltage, self-discharge and runtime of over-the-counter batteries. Available in AA, AAA and other sizes, these cells can be used in portable devices designed for these norms. Even though the cell voltages may vary, the end-of-discharge voltages are common, which is typically 1V/cell. Portable devices have some flexibility in terms of voltage range. It is important not to mix cells and to always use the same type of batteries in the holder. Safety concerns and voltage incompatibility prevent the sale of most lithium-ion batteries in AA and AAA formats.

Battery type	Capacity AA cell	Voltage	Self-discharge Capacity after 1 year storage	Runtime Estimated photos on digital camera
NiMH	2,700mAh, rechargeable	1.2V	50%	600 shots
Eneloop*	2,500mAh, rechargeable	1.2V	85%	500 shots
Regular alkaline	2,800mAh; non-rechargeable	1.5V	95% 10 year shelf life	100 shots
Reusable alkaline	2,000mAh; lower on subsequent recharge	1.4V	95%	100 shots

Lithium (Li-FeS2)	2,500–3,400mAh (non-rechargeable)	1.5V	Very low 10 year shelf life	690 shots

Table 2: Comparison of alkaline, reusable alkaline, Eneloop and NiMH
* Eneloop is a Panasonic (2013) trademark, based on NiMH.

High self-discharge is of ongoing concern to consumers using rechargeable batteries, and NiMH behaves like a leaky basketball or bicycle tire. A flashlight or portable entertainment device with a NiMH battery gets “flat” when put away for only a few weeks. Having to recharge the device before each use does not sit well with many consumers especially for flashlights that sit on standby for the occasional power-outage; alkaline keeps the charge for 10 years.

The Eneloop NiMH by Panasonic has reduced the self-discharge by a factor of six compared to earlier versions by Sanyo. These improvements were made possible with changes in chemical composition and a modified separator. This means you can store the charged battery six times longer than a regular NiMH before a recharge becomes necessary. The Panasonic NiMH are also said to perform well at cold temperatures. The drawback of the Eneloop to regular NiMH is a slightly lower specific energy.

Table 3 summarizes the advantages and limitations of industrial-grade NiMH. The table does not include the Eneloop and other consumer brands.

Advantages	30–40 percent higher capacity than a standard NiCd Less prone to memory than NiCd, can be rejuvenated Simple storage and transportation; not subject to regulatory control Environmentally friendly; contains only mild toxins Nickel content makes recycling profitable Wide temperature range
Limitations	Limited service life; deep discharge reduces service life Requires complex charge algorithm. Sensitive to overcharge Does not absorb overcharge well; trickle charge must be kept low Generates heat during fast charge and high-load discharge High self-discharge Coulombic efficiency only about 65% (99% with Li-ion)

Table 3: Advantages and limitations of NiMH batteries.

Nickel-iron (NiFe)

After inventing nickel-cadmium in 1899, Sweden’s Waldemar Jungner tried to substitute cadmium for iron to save money; however, poor charge efficiency and gassing (hydrogen formation) prompted him to abandon the development without securing a patent.

In 1901, Thomas Edison continued the development of the nickel-iron battery as a substitute to lead acid for electric vehicles. He claimed that nickel-iron, immersed in an alkaline electrolyte, was “far superior to batteries using lead plates in sulfuric acid.” He counted on the emerging electric vehicle market and lost out when gasoline-powered cars took over. His disappointment grew when the auto industry used lead acid as the battery for starter, lighting and ignition (SLI) instead of nickel-iron. (See BU-1002: Electric Powertrain, HEV, PHEV.)

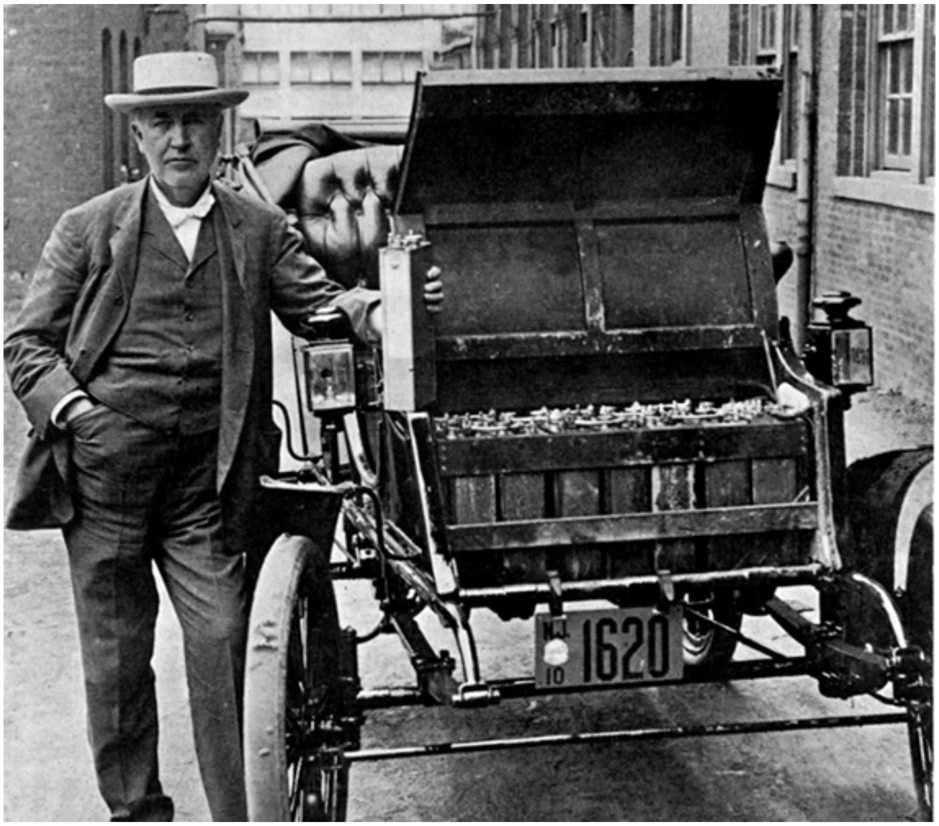

Figure 4: Thomas A. Edison and his improved storage battery.
Edison promoted Nickel-iron as being lighter and cleaner than lead acid. Lower operational costs were to offset the higher initial cost. In ca. 1901 Edison recognized the need for the electric car. He said that the same care should be given to the battery as the horse and railroad locomotive.
Source: Scientific America New York, January 14, 1911

The nickel-iron battery (NiFe) uses an oxide-hydroxide cathode and an iron anode with potassium hydroxide electrolyte that produces a nominal cell voltage of 1.20V. NiFe is resilient to overcharge and over-discharge and can last for more than 20 years in standby applications. Resistance to vibrations and high temperatures made NiFe the preferred battery for mining in Europe; during World War II the battery powered German V-1 flying bombs and the V-2 rockets. Other uses are railroad signaling, forklifts and stationary applications.

NiFe has a low specific energy of about 50Wh/kg, has poor low-temperature performance and exhibits high self-discharge of 20–40 percent a month. This, together with high manufacturing cost, prompted the industry to stay faithful to lead acid.

Improvements are being made, and NiFe is becoming a viable alternative to lead acid in off-grid power systems. Pocket plate technology lowered the self-discharge; the battery is virtually immune to over- and under-charging and should last for over 50 years. This compares to less than 12 years with deep cycle lead acids in cycling mode. NiFe costs about four times as much as lead acid and is comparable with Li-ion in purchase price.

Nickel-iron batteries use a taper charge similar to NiCd and NiMH. Do not use constant voltage charge as with lead acid and lithium-ion batteries, but allow the voltage to float freely. Similar to nickel-based batteries, the cell voltage begins to drop at full charge as the internal gas builds up and the temperature rises. Avoid overcharging as this causes water evaporation and dry-out. Only trickle charge to compensate self-discharge.

Low capacity can often be improved by applying a high discharge current of up to three times the C-rate for periods of 30 minutes. Assure that the temperature of the electrolyte does not exceed 46˚C (115˚F).

Nickel-zinc (NiZn)

Nickel-zinc is similar to nickel-cadmium in that it uses an alkaline electrolyte and a nickel electrode, but it differs in voltage; NiZn provides 1.65V/cell rather than 1.20V, which NiCd and NiMH deliver. NiZn charges at a constant current to 1.9V/cell and cannot take trickle charge, also known as maintenance charge. The specific energy is 100Wh/kg and can be cycled 200–300 times. NiZn has no heavy toxic materials and can easily be recycled. Some packaging is available in the AA cell format.

In 1901, Thomas Edison was awarded the U.S. patent for a rechargeable nickel–zinc battery system that was installed in rail cars between 1932 and 1948. NiZn suffered from high self-discharge and short cycle life caused by dendrite growth, which often led to an electrical short. Improvements in the electrolyte have reduced this problem, and NiZn is being considered again for commercial uses. Low cost, high power output and good temperature operating range make this chemistry attractive.

Nickel-hydrogen (NiH)

When research for nickel-metal-hydride began in 1967, problems with metal instabilities caused a shift towards the development of the nickel-hydrogen battery (NiH). NiH uses a steel canister to store hydrogen at a pressure of 8,270kPa (1,200psi). The cell includes solid nickel electrodes, hydrogen electrodes, gas screens and electrolyte that are encapsulated in the pressurized vessel.

NiH has a nominal cell voltage of 1.25V and the specific energy is 40–75Wh/kg. The advantages are long service life, even with full discharge cycles, good calendar life due to low corrosion, minimal self-discharge, and a remarkable temperature performance of –28°C to 54°C (–20°F to 130°F). These attributes make NiH ideal for satellite use. Scientists tried to develop NiH batteries for terrestrial use, but low specific energy and high cost worked against this endeavor. A single cell for a satellite application costs thousands of dollars. As NiH replaced NiCd in satellites, there is a move towards long-life Li-ion. (See BU-211: Alternate Battery Systems.)

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If you have a suggestion or would like to report an error, please use the "contact us" form or email us at: BatteryU@cadex.com. We like to hear from you but we cannot answer all inquiries. We recommend posting your question in the comment sections for the Battery University Group (BUG) to share.

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Basics You Should Know

- BU-003: Dedicatoria
- BU-104: Conociendo la Batería
- BU-302: Configuraciones de Baterías en Serie y Paralelo

Batteries in a Portable World

- Change-log of “Batteries in a Portable World,” 4th edition: Chapters 1 - 3
- Change-log of “Batteries in a Portable World,” 4th edition: Chapters 4 - 10
- Close Part Three Menu

Comments (38)

On February 15, 2011 at 10:02am

Muhammad hanif wrote:

our client have old Nickle Cadium battery and have obtained nicke cadium plate and after obtained nicke cadium plate melt in furnace and made ingot both items.
we we are interested seprate nicke and seprate cadium in chemical process or magnet sepraction or other process.pls advise us

On January 10, 2012 at 5:22pm

Bill Heintz wrote:

Can you add something on this page about Nickel-Iron (NiFe) alkaline batteries (Edison batteries).

I have an 3rd edition copy of Electric Circuits and Machines by Eugene C. Lister that only devotes a page or so of details. There and there are a few companies that still sell them; perhaps they are still a viable option for certain applications.

On January 21, 2012 at 2:45pm

Arild Jensen wrote:

NiFe batteries are experiencing a resurgence of interest because of their ability to store large amounts of energy for off-grid installations and the relatively benign environmental impact compared tp lead plated sulphuric acid electrolyte batteries. Indications are these batteries can remain in use for decades thus also reducing sending them to a land fill site or requiring expensive recycling facilities.

On January 26, 2012 at 9:53am

Bill Heintz wrote:

The NiFe battery is already covered in the “Battery Types / Alternate Battery Systems” Section.

On March 10, 2012 at 10:49pm

Herald wrote:

I am looking for data on industrial nickle cadmium battery heat emission during charging and discharging

On March 11, 2012 at 1:13pm

Raydel Crego wrote:

I was going to buy your book because of all the expert information it contains,but was really hopping it would include the new generation NiMH low self discharge batteries and learn all the detais about them,it seems great not having to trough the endless total discharge/charge cicles to condition the regular batteries,plus the long shelf life they seem like the cutting edge in technology.Will you be publishing information on these newer NiMH batteries soon

On March 13, 2012 at 12:17pm

Dobra Georgian wrote:

hi,
NiMH batteries are new for me and I want to find some tips for charging and preserving them,I announce you that I have 4 AA batteries Energizer of 2500 mAh and 4 Sanyo 2700 mAh normal (not LSD) and 4-channel smart charger that charge all batteries fully discharged in 3 hours:
1. keeping the battery empty for a week or longer is damaging it ?
2. if the battery is at 70% of capacity and I begin charging , is this damaging it ?
3. how to prevent self discharge as much as possible

4. what is the best use on low temperatures (sometimes if I am outside and is cold my camera wont want even to start and if I come inside the batteries restores and the camera is working ; is there a way to make the camera work at that low temperatures (0 C) not fully charged ?)
5. the charge cycle of NiMh is the same as charge cycle of Li-Ion (0% to 100% or 2 times 50% to 100% etc .)?

thank you !

On March 22, 2012 at 8:58pm

Glen Nelson wrote:

Battery operated power tools.

I have been using battery operated power tools for a long time. Why is it that the lithium powered tools require new batteries more often? They are also more expensive. I like the older NiCad technology for tools. I have NiCad batteries purchased in 2004 that are still performing close to new. The trick w/NiCad is to use it, then cool it, then charge it. I don't overheat them. My first lithium tool kit was purchased in 2008 and NONE of of the batteries from that era work anymore. The lithium tools have grunt and long run time between charges but they die out of the blue and only last a couple of years.

Should I take a chance and buy a new set of Lithium? have they improved the shortcomings on the batteries listed above?

On June 15, 2012 at 2:29pm

John wrote:

Can somebody tell me the advantages and disadvantages of higher and lower MAH ratings? I read somewhere that higher MAH is not always better. Thanks.

On October 21, 2012 at 10:41am

Peter Valúch wrote:

Hello, I am doing a research about batteries used in hybrid cars. And I need to put the references on my reference list. I would like to know who is the author of this article.
Thank you very much.

On October 21, 2012 at 5:06pm

photon wrote:

Hello, Do NiMH need calibration ? Thank you!

On January 15, 2013 at 6:51am

BOB MEUSE wrote:

I have a recording machine with a built-in charger for a sealed NiCad battery pack.
The battery pack has just been rebuilt with Ni MH cells.
Will the charger or the battery be damaged now that the battery is Ni MH?

On January 25, 2013 at 10:32am

Mike Streeter wrote:

I performed a test discharge of a battery pack consistng of 7 Sanyo HR-3U (NiMH 2700 mAh) batteries in series. The discharge was at a rate of roughly 0.3 C. Initial voltage/current was 8.5 volts and 0.75 Amps. Test circuit consisted of the battery pack in series with a 12 ohm resistor and an Ammeter. The battery pack discharged in a linear fashion for an hour and then the voltage across the battery pack ramped up rapidly to 13 volts. I discontinued the discharge for an hour and then reconnected the circuit. Battery voltage was 8.0 volts. Any ideas what could cause the Battery voltage to ramp up to 13 volts? I have reviewed technical info on these Batteries and have not found any thing that describes this kind of effect on a discharge cycle.

On March 6, 2013 at 1:13pm

Slocket wrote:

BOB MEUSE wrote:

I have a recording machine with a built-in charger for a sealed NiCad battery pack.
The battery pack has just been rebuilt with Ni MH cells.
Will the charger or the battery be damaged now that the battery is Ni MH?
——————————————–

Most smart chargers look for the -Delta V drop of NiCd when they are close to 100% full charge. NiMH does not have that drop (much) you could overcharge them. Make sure your charger is smart enough to stop charging anyway - it could have different mechanism and thermal shut off etc to prevent over charging. Give it a charge cycle and see how hot they get, hot battery is sure indication of overcharging which tends to absolutely ruin Lithium battery but NiMH are tougher but do not let them overcharge to get hot. Get an real NiMH charger if in doubt or hot battery after a charge session.

On May 10, 2013 at 7:04am

Achim wrote:

I have an electric tooth brush with a NiCd battery inside and use it now for about nine yeras with estimated 500-800 full charge discharge cycles - still working fine with only a moderate capacity loss. The newer model of my wife has a NiMH battery which cannot be exchanged - I expect a much shorter life and doubt that throwing the whole tooth brush after few years of use is more envrontally friendly. Why then do manufacturers withdraw the NiCd variants ?

On May 14, 2013 at 6:32am

Rob Davidowitz wrote:

This may be a silly question so please forgive my battery ignorance.

Is there a way of measuring the remaining capacity in MaH by using a multimeter?

Eg: To measure voltage, I attach the positive lead to positive pole and same for negative and read Voltage - No problem

How do I measure the X of 2100Mah left in the battery?

Thanks
Rob

On June 7, 2013 at 7:34am

thumar rushik wrote:

please give me information about Charging voltage and current for nickel based battery, because over voltage charging battery ay be explode the battery .

On August 11, 2013 at 1:45pm

TravisE wrote:

The article is either wrong or not telling the true story on the so-called memory effect and/or needs some citations. Most sources I've read say that this ONLY applies to sintered plate NiCd cells that are repeatedly discharged to PRECISELY the same SoC (which in itself is difficult enough to achieve in practice) and charged WITHOUT any overcharge. This is exceedingly unlikely to happen in any consumer cells even if they were of the sintered plate type. The only effect I have personally ever seen with nickel-based batteries that involve reduced capacity has been permanent degradation due to defective or worn out cells. This is NOT a memory effect.

On September 18, 2013 at 9:22am

Crimson Halo wrote:

Please update this page! Low self-discharge NiMHs have evolved and have really come into their own ... they're better than yesteryear;s NiMHs and give at least the same performance if not more, the discharge curve is relatively flat, and in my own experience I know they can take hundreds if not thousands of cycles.

On September 20, 2013 at 11:12am

PFWAG wrote:

The newer NiMh batteries, like Sanyo/Panasonic's Eneloop brand, have VERY LOW self discharge rates with only a small hit on capacity..If I remember correctly, they retain about 70% of power after 3 years. Great in your flashlights and cameras that might sit for a long time without the batteries being re-charged..

On November 16, 2013 at 8:25am

Forncett wrote:

Nickel isn't toxic? Are you kidding me?? Take a look at the video in Great Railway Journeys of the World where the travelers go deep into a remote part of Russia and encounter mile upon mile of devastation caused by nickel mining that's poisoned everything within its reach, and permanently so far as the lifespan of the human race is concerned. Or if that's too hard, Google "is nickel toxic?"...

You've got a great website that my power design-engineer and technical editor roles fully appreciate - please don't pollute it with misinformation!

On December 27, 2013 at 8:17pm

Ludwig Merk wrote:

There is a lot of writing about capacity, current, nominal voltage, recharging current/amps - but whats about recgarging voltage?
I measured chargers for single cell and power tool packs, both are recharging with 5.0 volts regardles if its for 1 cell or a pack of 10 cells (=12V pack) in a row.
It it always 5.0 volts?

On January 19, 2014 at 8:20am

senthil wrote:

how many nickel% is in nickel cadium batteries. please tell the detail.

On May 30, 2014 at 11:49pm

fine raja wrote:

informative!I have a recording machine with a built-in charger for a sealed NiCad battery pack.
The battery pack has just been rebuilt with Ni MH cells.

On May 30, 2014 at 11:51pm

SELVAN S wrote:

Very interesting information.I need to put the references on my reference list. I would like to know who is the author of this article.

On June 25, 2014 at 7:40am

Srinivas vithalapur wrote:

From the material published in the section (charging batteries at high and low temperatures) that charge acceptance gets reduced at higher temperatures for NIckel cadmium batteries. Does this mean that Nickel cadmium battery discharge duration, gets reduced while charging at higher temperatures ?

As per IEC 60623, governing standard for NIckel Cadmium batteries, it is mentioned that while testing the battery for capacity, temperatures shall be 25 degree C. Is there any standard which will tell that what shall be the degradation with battery discharge performance, if charged and discharged above the temperature range (> 25 degree C) ?

Kindly clarify and help

On July 25, 2014 at 9:16pm

Mark wrote:

Some interesting stuff. I've always preferred NiMH myself.

On February 22, 2015 at 1:13pm

phoenix wrote:

After a large wildfire that burned several farms and houses, we found our John Deere tractor (which was consumed in the fire; all non-metal objects completely gone) had dripped a silvery metal onto the ground and formed a puddle that cooled and solidified into a very beautiful shiny shape, about 8oz. The metal appears very clean and it was the only metal that melted in the tractor. We are trying to research what this metal is and which part of the tractor it came from. Could it be a nickel-based material from the battery perhaps?

On June 30, 2015 at 10:57pm

kotreshi c k wrote:

i want features comparison between the lead acid battery and lithium ion battery and nickel metal hydride

On July 22, 2016 at 9:53pm

vijay wrote:

Very interesting information.I would like to know who is the author of this article. and i want to say thank you .

On October 5, 2016 at 2:26am

John Bellock wrote:

Very interesting information. I use NiMH batteries (Panasonic Eneloop, Duracell Staycharge and other) with Low Self Discharge technology and this kind of batteries are very reliable and solid as a rock. No more self discharge NiMH classic batteries. I recommend to use a good charger (for example Powerex Maha models) and you will have batteries for years. I use it in bluetooth keyboards and mice, videogames remote controls, linterns, etc.

On December 14, 2016 at 4:03am

rkriponbanglad1 wrote:

so beautiful site list

On April 8, 2017 at 6:02pm

Cornelius wrote:

I like learn more of batteries

On August 15, 2017 at 1:50am

Errol Pearce wrote:

A simple question: What is the shelf life from new of a NiCD SC2.0AH cell in reasonable climatic conditions say 20 -30 C

On October 16, 2017 at 2:11am

Alborz wrote:

do you have any information of aging of NiCd batteries? i have a lot of them in a store i want to see how long they stay without failure. and also my clients wnt to know that .

On March 11, 2019 at 7:56pm

Walter Rowntree wrote:

There has been a lot of recent improvements in Ni-Zn. See the Ni-Zn chapter in the 5th edition of Linden's Battery Handbook (due out in June). cycle lifetime are now up to 500 at 100% DOD and 8000 at 10% DOD. ZAF energy systems prototype batteries will take a trickle charge. Major drawback is that they still have 10% self discharge per month. But they are far safer than Lithium, and have no toxic or regulated metals. Wirtz manufacturing has recently demonstrated that the membrane can be manufactured at speed on the same equipment used for sealed Pb-acid, with only minor modifications. When manufacturing is scaled to 1M batteries per month cost per lifetime Ah delivered (in a G31 size battery, i.e. 7 Ni-Zn cells) will be less than Pb-acid, and will likely supplant this in SLI markets, and be more competitive for stationary storage (where energy/kg is not critical) than Li.

On November 2, 2019 at 9:06am

Steve C wrote:

I use some legacy electronic devices in my pursuit of the amateur radio hobby, and some of the devices use older rechargeable batteries, (specifically NiMh type shrink wrapped packs of four AA sized cells with a cable equipped with a miniature terminal plug that corresponds to a fixed two pin terminal socket on the circuit board). The device is a frequency counter, and it is assumed that the DC voltage/milliamperage delivery requirements of the device's circuitry account for the degrading characteristics of battery consumption without affecting the accuracy of readings that are displayed when the counter is in use.

Is there any functional difference in the circuit as long as the supplied voltage and milliamps are within the operating range of the device? I would like to know if lithium ion rechargeable batteries can be used in this device, (knowing that recharging them in the circuit as designed for NiMh batteries will not work with lithium chemistry equivalent dimensional type batteries – I would have to charge them outboard using a charger designed for lithium batteries).

I think this question is valid in view of the discontinuance of the chemistry becoming an issue, such as was the case with non rechargeable mercury based batteries in photo equipment manufactured in the 1960's – 1970's era. One such camera I own now uses a zinc/air battery made to fit the cavity of the previous mercury cell, which exhibits a differential in the exposure readings of the meter – requiring compensation in order to get the correct exposure on the film. Since the camera is obsolete, and film becoming a more or less supplanted medium by digital photography this issue does not concern me, however the frequency counter is still a useful tool in amateur radio, and if the battery chemistry is deemed a toxic disposal problem and thus discontinued I would like to be able to keep using my older tech device rather than replacing it for something else.

I also hope my question provides help for others who may be in the same situation someday, and this kind of information isn't commonly available, from my experience.

On February 28, 2020 at 3:29am

NabuN wrote:

@Steve

Yes, you can, but it needs little work to adapt the voltage. You can use Li-Ion, better LiPo (see RC hobby), 2 cells in series, 2S1P / or one pack of 2 , having 2..3 Ah capacity. Usual devices powered by NiCd / NiMH cells do not have internal stabiliser in mostly cases, so we need a voltage reduction from max. 8.4V (Li-Ion pack, full charged) to 6V. 2 (two) common silicium diodes connected in series having maximum current higher than the device working current will reduce input voltage to 6.5 V, which seems OK. I made this adaptations in few cases, it was ok and time on battery increased substantially.