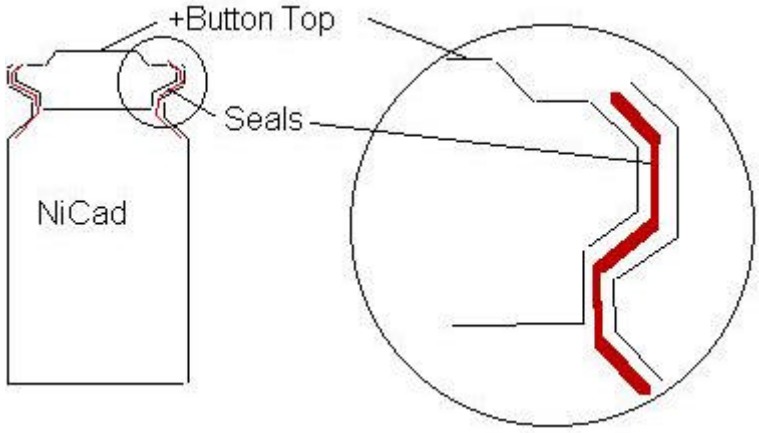
Soldering Batteries

by Blake Nielsen

Soldering is much like utilizing adhesives. Many of the same rules apply. Soldering involves binding two objects together with melted metal. One of the most common metals is 60/40 solder, which contains 60% tin and 40% lead alloy. Just as with adhesives, the ability of the solder to wet, or flow onto and into the irregularities greatly improves its joint characteristics. A Rosin-core flux, facilitates its ability to wet the two surfaces.

One other critical component to soldering batteries is to sufficiently heat the solder, and battery terminals without frying the batteries being soldered. NiCad batteries are heat sensitive and can be deleteriously affected with too much heat. Some suggest spot-welded solder tabs to avoid overheating the batteries. However, for the high current demands of electrics, tabs often provide too high of resistance, resulting in poor current flow and corresponding poor battery pack performance.



If you have ever recharged NiCads, especially at a high current rate, you have felt the pack get quite warm towards the end of the cycle. To allow gasses to escape that naturally occur during the charging cycle, these batteries have been engineered with a seal that vents gas build-up. The seal also acts to insulate the cathode from the anode. These seals are close to the ends of the batteries. Our soldering irons produce far more heat than these sensitive seals can tolerate. If we are not careful, this could potentially melt or damage them. Melting the seals will allow the internal battery electrolyte to dry out or leak prematurely, which will significantly shorten the cells life.

Now armed with the challenges of soldering NiCads, how to overcome them…

Squeaky Clean

Surface prep is the first, perhaps most critical, step in ensuring: adequate heat transfer, good solder wetting, and ultimate joint strength. The surfaces need to be free of wax, oil and surface oxidation. If you can't get the surface clean, give up. It ain't gunna work. I like to take a safe sided disk in my dental handpiece (dremmel will work fine) to freshen the ends of the battery. This will quickly remove the top, contaminated layer, as well as provide micro irregularities for the solder to "grab" into. Now, don't touch the ends, you have just freshened, if your hands are wet and sweaty, you have just recontaminated them.

The soldering iron head should be cleaned on both ends. Rosin, the flux, can be burned and turn dark brown or black. This inhibits heat transfer and can contribute to surface contamination that you have worked so hard to clean. To clean the head of the soldering iron, I like to periodically "tin" both sides. To do this, I wipe them clean while the head is hot with steel wool, and then apply a thin layer of new solder. Others will use a wet sponge or cloth to wipe the tip of the hot iron.

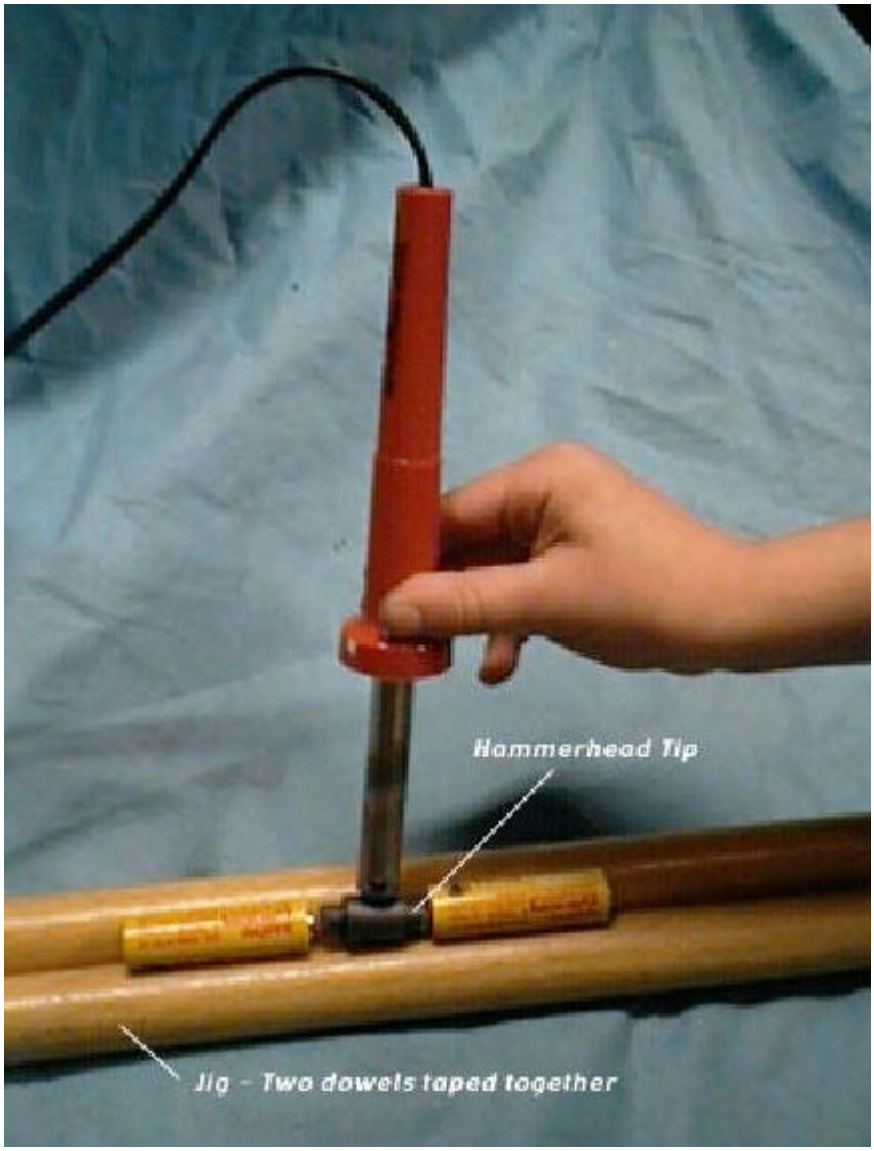
Tinning

Now that you know that too much heat is bad, and too little heat will not work. The trick is to learn the proper amount and timing to solder, to avoid damaging the battery cells. From a technique standpoint, the goal is to apply just enough heat to allow the solder to melt and flow freely. You'll be surprised how little it takes, if the surfaces have been prepared correctly.

The first step is to tin the ends of the cells. Shortly after cleaning the ends of the soldering iron, touch a small amount of solder to the tip of the iron then place the tip to the cell. Depending on the heat of your iron, usually less than 1-2 seconds. Done in this fashion, the flux will still activate and flow freely over the end of the cell where the heat was applied. It is important not to apply too much solder on the tinned end. If you do, it tends to splash or flow out the sides, when you squeeze the cells together later. This may even short a cell. The solder will have a shine as it cools. Do not disturb it or it may turn dull or crystalline. This compromises the joint and characteristics of conductance.

Jig

I don't care how good you are with your hands; a jig is indispensable for making these packs. Tom likes to use a high tech piece of left over aluminum. I have the Radio-shack version, two pieces of dowel, taped together. The goal here is to align the ends of the cells to allow soldering while the cells are squeezed together. Some even suggests that a vertical jig is required, with non-conductive gaskets to protect the positive end of the battery. I have made lots of packs, utilizing the horizontal jig without plastic washers and have not experienced the problems associates with not being vertical. I suggest, do what suits you best.



Soldering Technique

Now with the ends tinned and the cells aligned in the jig. Place the hammerhead tip between the cells and simultaneously heat both ends briefly. Then, as soon as you remove the iron, gently squeeze them together. Slamming can splash the solder, possibly injuring an eye or making molten solder fly to spots that can short the cell. Allow them to cool, undisturbed. This will provide an

adequate joint, with minimal thermal impact on the seals. Inspect the joint for adequate solder, excess solder, solder droplets, etc., and make any adjustments for the next solder joint to be made. You will learn by doing in this fashion with each joint, rather than taking them all to completion with the same boo-boo.

To connect cells at the ends, I like to use desoldering braided copper. Make sure you tin the ends of the braid before you try to solder. It is designed to wick up the solder and can take a fair amount before it will flow evenly between the cell and the braid. You might also heat it first before you place it against the cells. This will minimize heat transfer to the batteries internal seal and electrolyte.

The Solder

Acid flux solder is best left to plumbing, it is prone to corrosion problems, which can seriously affect conductivity, so use Rosin- core solder. A good solder joint is smooth, shiny, and concave. Be aware that solder joints are fragile as they cool. If you move the joint while it is cooling, it crystallizes and the strength and conductivity of the joint is severely compromised.

Batteries

Don't you ever try to solder button type cells. They can explode. Nuff said.

The Iron

Don't try to use a soldering gun, even though they have their high wattage, and a cool light to illuminate your work and some even will buzz when you pull the trigger. They don't work nearly as well as a simple, inexpensive Weller SP40, pencil-style soldering iron.

New Creations RC caries a Hammer Head Soldering Tip (#WSP40). Last I saw, he wants $8.25 for the tip. It is requisite to make end-to-end packs. It is the only way I am aware to adequately heat two cells simultaneously for soldering end-to-end packs, without overheating or damaging the individual cells.