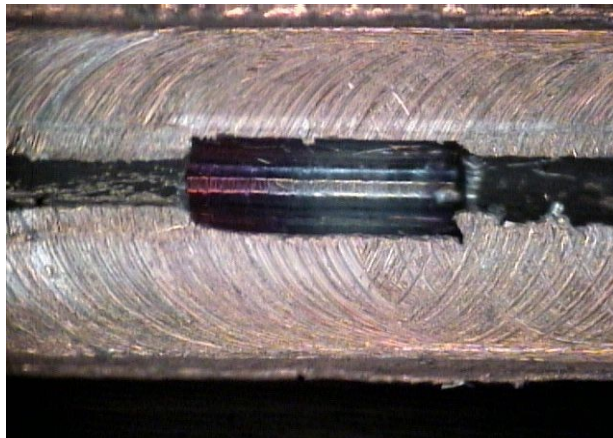


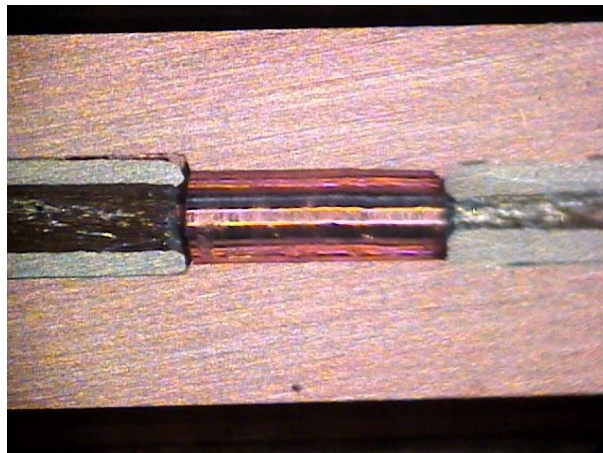
A quick review of the 5 tests run and their findings

Initial Test1

A .880" long .125" dia. Copper rod was bored thru with a .032" and then bored .041" in .400" from both ends leaving a .080" long center section. Short pieces of capillary tubing were, one at a time, placed in while in a vertical position. Hand-feeding common 60/40 flux core solder was used with a pencil iron heating the copper from the side. I had to add a little paste flux to get a good flow. After flycutting I observed what I thought might be blobs of solder in the cavity and flux intrusion into the capillary. See below.



After wet sanding and acid etch, This is what could be seen. Note darkened cap. tube on the left (flux).

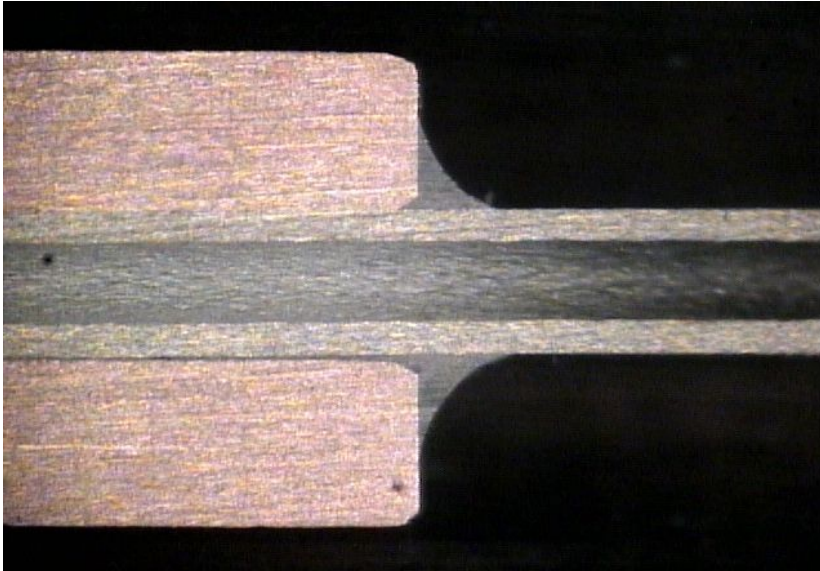


What was learned was a soldering iron was awkward and somewhat ineffective. Paste flux not ideal tho the part did pass pressure/vac tests. Solder amount needs to be controlled.

Test 2

Changing the overall length to .800", I bored thru again with a .032" then bored in .350" with a .039" then in .300" with a .041". This gives a .050" long tight alignment section near the cavity on both ends. I wrapped one circle of .021" dia. Solder at the base of the joint and changing to a propane torch and a drop of liquid flux, heated the part till the solder flowed into the joint, one end at a time.

Note nice fillets



Bore misalignment and aggressive and excessive solder flow, flux intrusion.



Darkened area is hardened flux



Overall view, again note dark flux intrusion areas

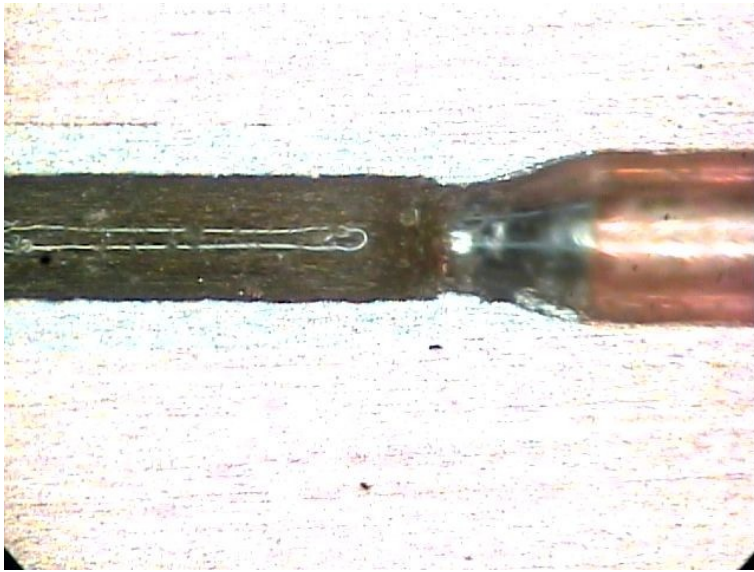


Lessons learned, Limit solder to exact amount needed, exact precision at all steps of sleeve manufacture, Address flux intrusion, heat control.

Test 3

Essentially the same setup but halved the amount of solder to $\frac{1}{2}$ wrap each end, same amount of flux.

Hardened flux dam (dark area at center)



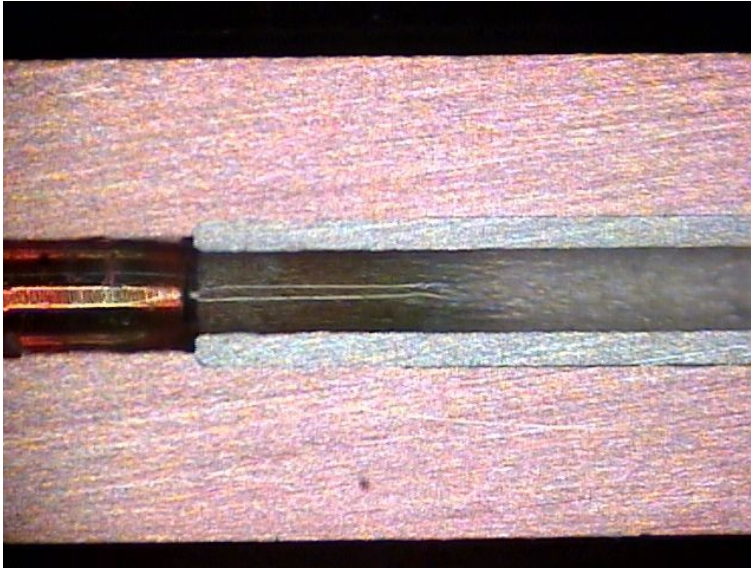
After cleaning with flux solvent



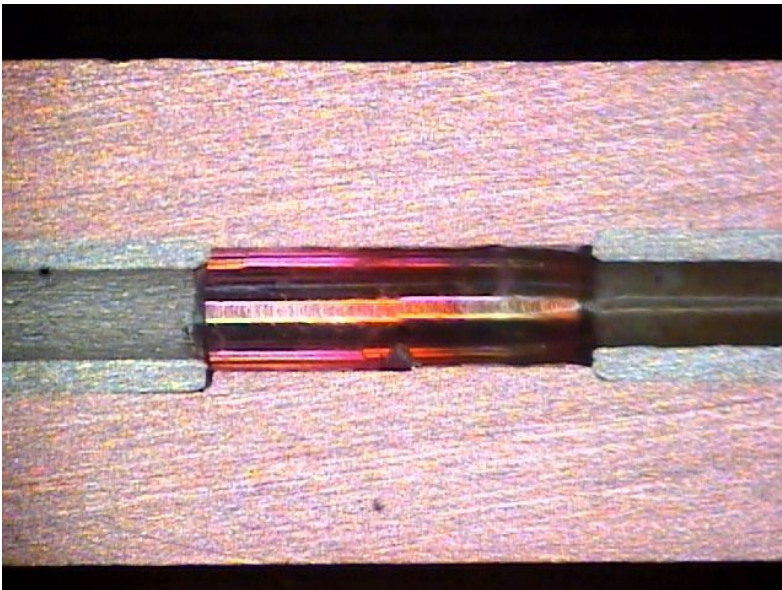
Lessons learned, Still too much solder, too much or wrong flux

Test 4

Again the same setup but used $\frac{1}{4}$ wrap solder and just a light swipe with a toothpick tip soaked in flux
Solder under control but still flux inside the cap. tube.



...but only one one side

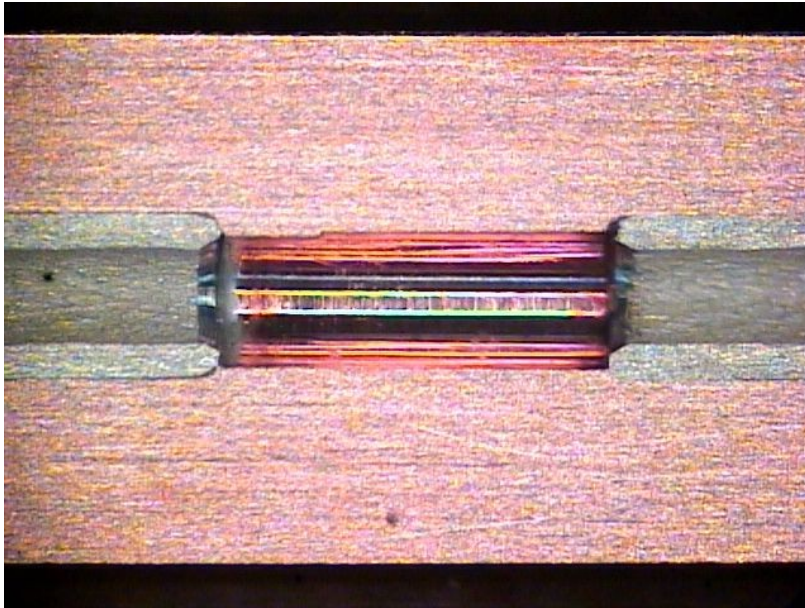


Lesson....The liquid flux is working too well, is too invasive, I think it has to go. Solder amount may now be too little.

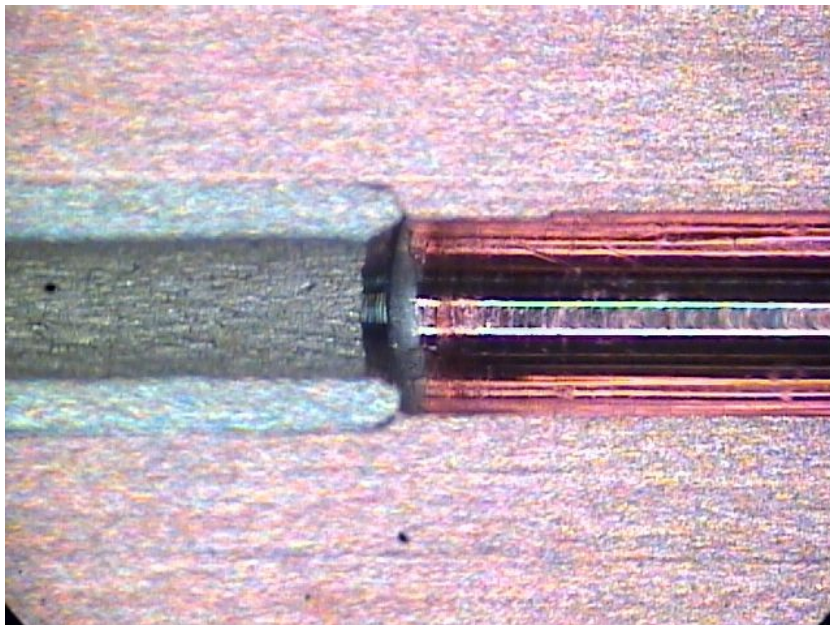
Test 5

This last test uses 1/3 wrap solder with NO liquid flux. I found that I needed more heat to get the solder to flow completely into the joint. It would at first ball-up on the end of the copper and with a little more heat would drop into the joint. The copper would show some discoloration. I had to acid etch the 2nd side end before proceeding to solder to remove oxidation.

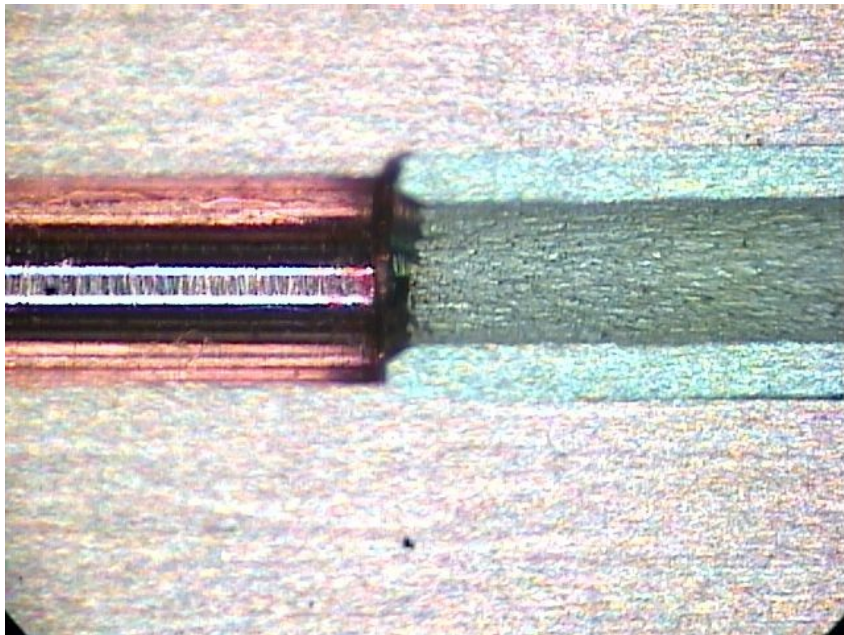
No flux intrusion, a little solder showing on the left



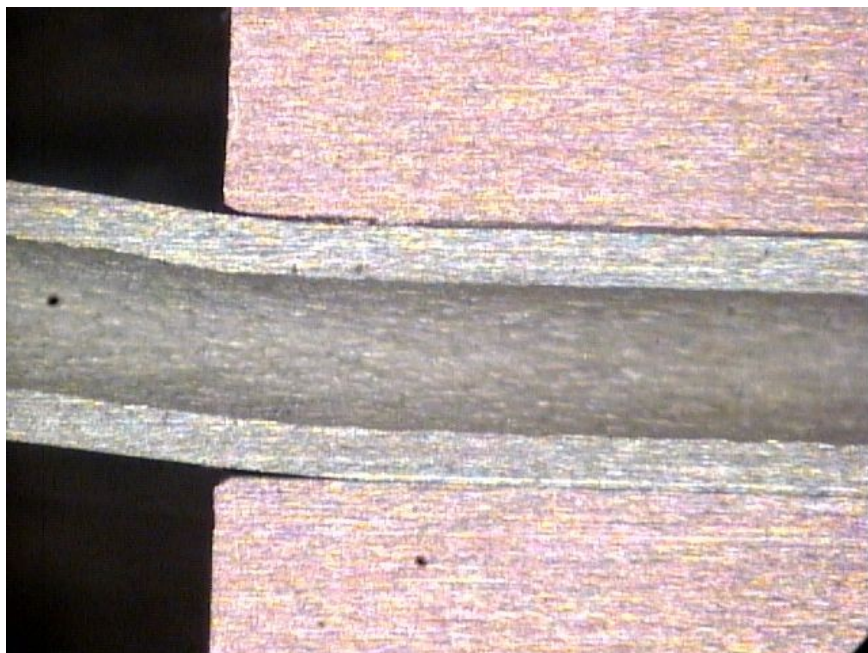
close-up of left side



Right side. No solder showing but good fill along length



No fillet, but still good fill along length



Overall shot



The last 4 tests were not pressure/vac checked as I was addressing the flux and solder amount problems but I believe they would be tight. More complete tests will be run when a proper solder/flux combination is settled on. I will also try a different heating setup using a small butane-catalytic heat gun.

Rodney Post LBNL