Statements and Infos on the Web concerning welding of Evanohm

http://www.eevblog.com/forum/metrology/esi-sr1-standard-resistor-current-rating/msg975448/#msg975448

According to metallurgists and industry experience (mine included), you cannot solder to Evanohm alloys and get a bond like with copper or silver, what you get is a mechanical joint in effect, better than a crimped joint perhaps but still only a mechanical joint. The long term stability of this joint is guaranteed to be less stable than a welded joint. As evidenced by long term measurements of resistors with non-welded joints, they are significantly less stable with time. They are unstable even sitting on a shelf and will exhibit high drift with time.

If you can tolerate long term drift of 100 PPM or more over time, then your mechanical joint will suffice, otherwise you are wasting your time soldering. While there are fluxes which will adhere to steel and stainless, they cannot be used with Evanohm and there is no flux that works with Evanohm alloys. Welding is the only option for stability and it must be done with compatible materials, **you cannot weld Evanohm to copper** although you can weld it to alloy 180 with fair success. All of my resistors are welded with 100% compatible materials.

https://www.edn.com/Home/PrintView?contentItemId=4427151

From here on, it was we missed the train and the depot to boot! The first question was “How do I weld?” The answer----“Y**ou can’t spot weld Evanohm to copper** (the wire leads).” The melting points and hardnesses are too dissimilar. The solution----let’s find an intermediate material that will weld to both. After many trials, someone found that 180 Alloy, a blend of copper and nickel, seemed to do the trick. It would stick to the copper lead, sort of and when folded into a “V” to hold the wire, would weld shut. This clamped the wire making a joint that seemed good. Seemed is a very good choice of words. The 180 Alloy welded to itself, the copper lead and the wire sandwiched in the “V” forming a braze with the alloy; one side of the “V” welding to the other, resulting in a mechanical joint in which the wire was entrapped. Much ado was made about the “welding” process. It augured in a whole new era in the electronics industry.

https://www.eevblog.com/forum/reviews/precision-resistor-standard/msg465274/#msg465274

Evanohm is definitely weldable, the big problem was that everybody (except the primary Evanohm standards and myself) was trying to weld an un-weldable joint, those bad welds are still being used in the industry which generally limits the performance and stability of those resistors. As per my articles, the bad solution of baking the heck out of them weeded out the worst offenders and those with tight crimp joints made it through. As I admitted elsewhere, I have not personally inspected every brand of PWW resistor on the planet but their performance speaks volumes. The PWW industry has a long and jaded history of borrowing 'ideas' from each other. All of the 'sandwich' terminations discussed in the articles were thought of almost entirely in the 1960s, I have not seen anything new except possibly some really odd combinations of those sandwiches since.

While solving the weld problem removed a major source of trouble, other, more subtle effects were revealed which also contributed to poor performance, once those were taken care of then state-of-the-art performance was possible, until further material improvements can be made, it is as good as it can get for the time being.

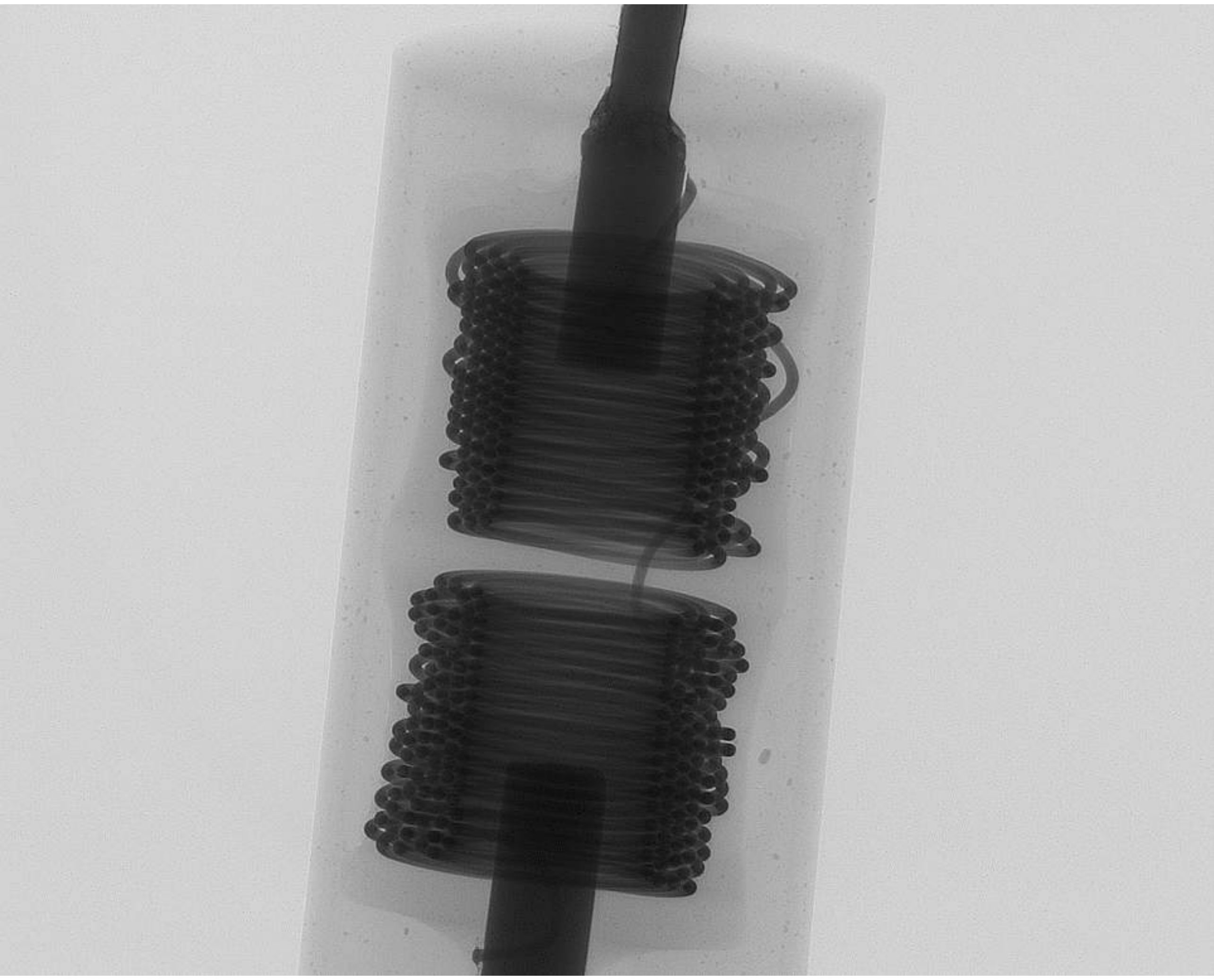
Yes, it is possible to use both the Evanohm alloy (which goes by several other names too) and other similar alloys to create different combined TCRs, it has generally not been done due to some difficulties encountered in the manufacturing process, it has been done in the past but in a clumsy manner which turned out to not be good enough for a production line. The technique is called splicing.

https://www.eevblog.com/forum/metrology/ultra-precision-reference-ltz1000/msg628233/#msg628233

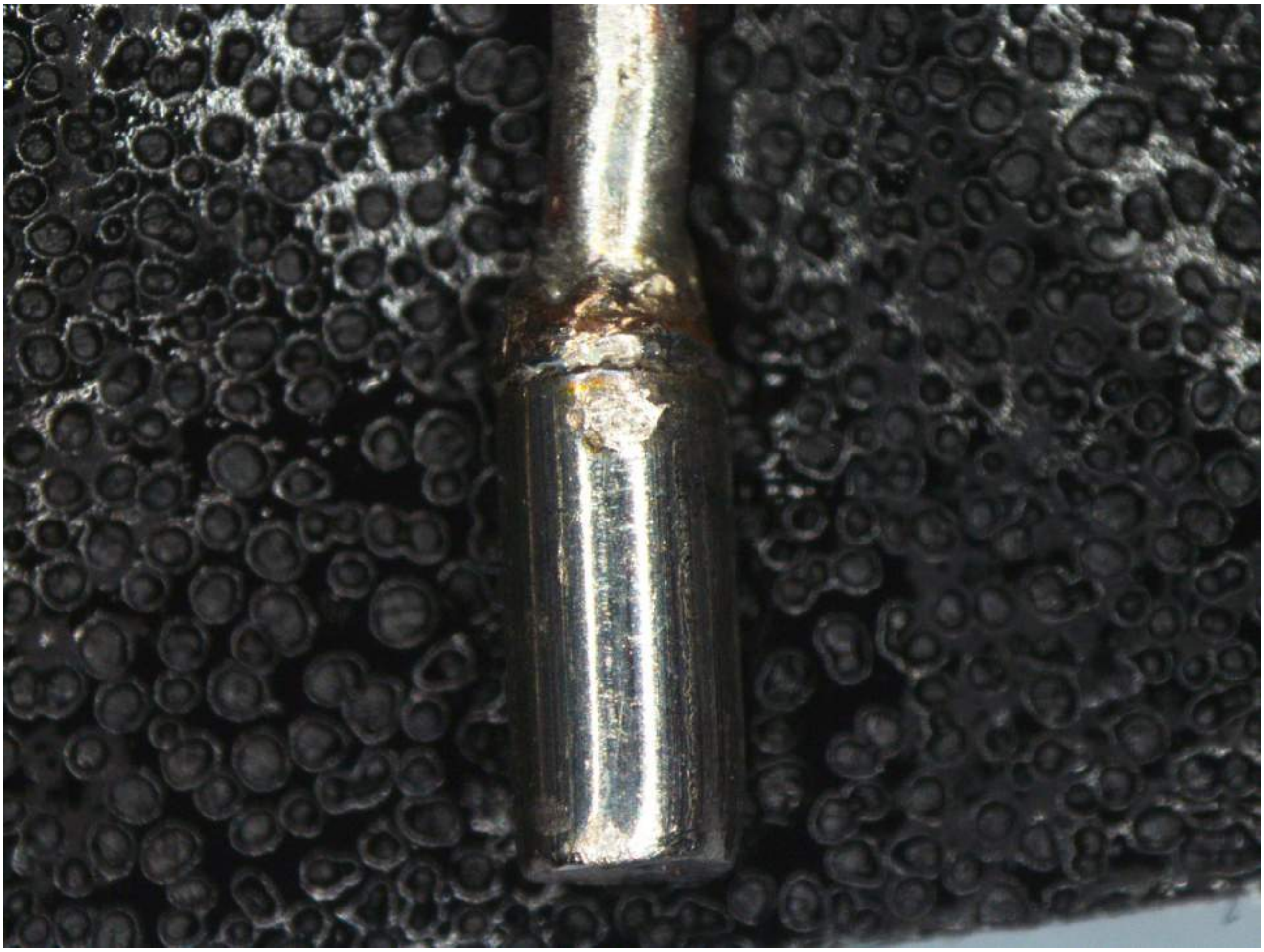
Actually, the mandrel is that part of the bobbin on which the wire is wound, a collet is what holds the lead assembly of the bobbin and the collet is screwed into a shaft driven by the motor. The diameter of the mandrel is what limits the possibility of putting two lead assemblies into each end of the bobbin, this is a physical limitation.

Evanohm is welded using a CD welder, that is the simple part of it, the rest of the detail is in the design of the resistor, lead assemblies and electrodes. As I told DiligentMinds, it is not the type of welding that can easily be accomplished by a novice in order to achieve a quality weld.

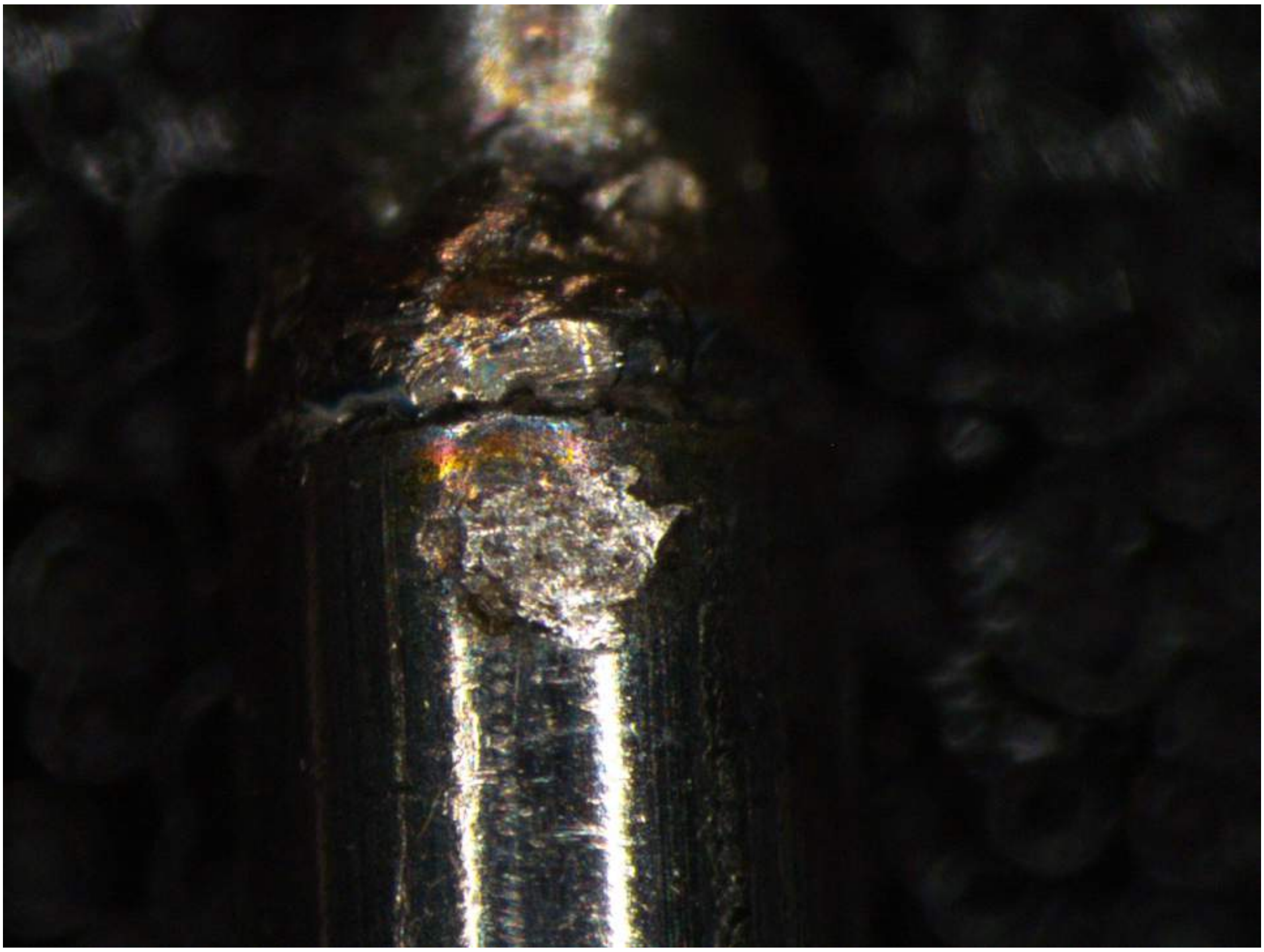
X-ray Image of Ultrohm Plus 120R resistor



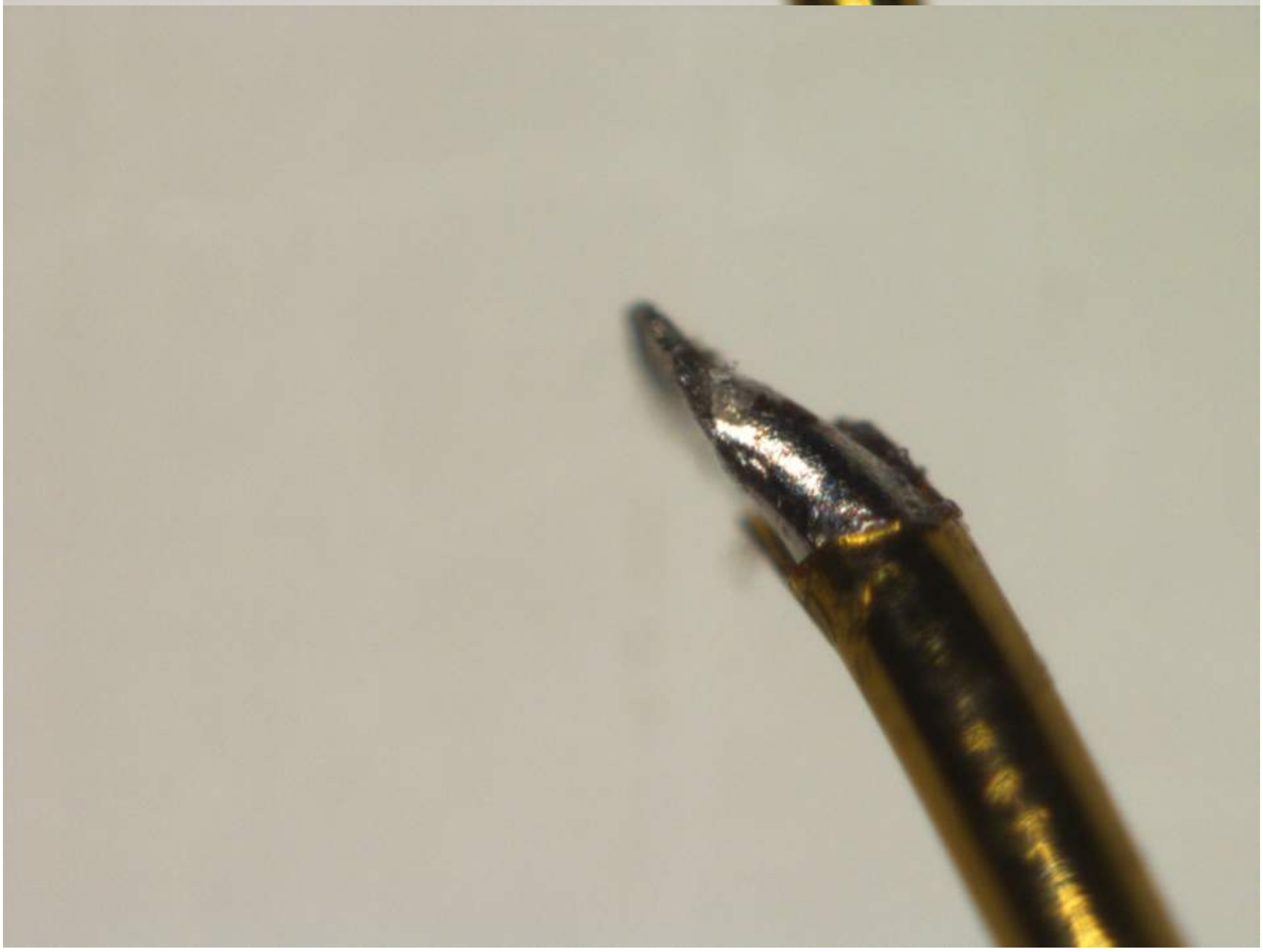
Microscope Pictures of Ultrohm Plus Lead Assembly



Copper wire welded to intermediate material → Butt-Weld?
Intermediate material is about 1.3mm in diameter (AWG16) and 3mm long, while the copper lead is 0,81mm in diameter (AWG20)



Weld joint of Evanohm wire to intermediate material, after Evanohm resistor wire has been removed → Capacity Discharge weld



Evanohm resistor wire end

EDX Analysis and Material Comparison of Ultrohm Plus resistor construction

https://books.google.de/books?id=RzMOiOEQ-oMC&pg=PA424&lpg=PA424&dq=welding+evanohm&source=bl&ots=wOj95g7OUI&sig=y2dL4E3cuSH5gqc9bDW6n5BvaIY&hl=de&sa=X&ved=0ahUKEwiJiuLalP7YAhUHfFAKHQaXC1YQ6AEITjAI#v=onepage&q=welding%20evanohm&f=false

	EDX	EDX	EDX	EDX	Isaohm	Evanohm Alloy R	Evanohm Alloy S	Evanohm	Evanohm
		recalculated		recalculated		Carpenter Technology Corp.	Carpenter Technology Corp.	Gilby-Fodor S.A.	Wilbur B. Driver Co.
C	3,55		3,70						
O	3,31		2,18						
Al	4,17	4,48	3,98	4,23	3,50	2,50	3,00	3,00	2,75
Si	1,21	1,30	1,13	1,20	1,00		1,00		
Cr	18,95	20,35	19,10	20,29	20,00	20,00	20,00	20,00	20,00
Mn	1,09	1,17	1,12	1,19	0,50		4,00		
Ni	66,13	71,02	67,05	71,24	74,50	75,00	72,00	75,00	75,00
Cu	1,57	1,69	1,74	1,85		2,50		2,00	2,75
Fe					0,50				
Total	93,12	100	94,12	100	100	100	100	100	100,5

EDX analysis and intercomparison of material composition from different Evanohm provider shows, that intermediate material is Evanohm

C K	5,74	C K	12,10
O K	1,65	O K	2,61
Al K	0,36	Al K	0,51
Si K	1,53	Si K	1,50
		Ca K	0,22
Cu K	87,55	Cu K	82,66
Sn L	3,17	Sn L	0,39
Total	100	Total	99,99

EDX analysis of the lead wire shows a tinned copper wire