

RE: Copper analysis 4/16/04

Frank:

Attached is the chemical analysis for the copper samples.

The results in my opinion is that the material will behave properly in hydrogen atmosphere furnace brazing, however compliance to the specification, and just how that will affect the properties required by the designers is another issue.

The results are a mixed bag of considerations.

Your order for the material was for ASTM F68 C101. The F68 standard in itself does not carry a chemical analysis requirement, however the C101 designation does. There are however numerous specifications in F68 that can be used to refer you to chemical analysis requirements for the C101 designation. You requested chemical certification.

When determining the chemical analysis of OFC alloys, the exact method of analysis is critical, and most methods will give relatively crude results. In the ASTM specifications for chemical analysis of C101 copper, the standards make the statement that the method of chemical analysis is to be agreed upon between the customer and supplier. We did not do this, so we are stuck with what the vendor supplies.

I referenced ASTM B170 Grade 1 (C101) (a specification for refinery shapes) as the requirement for chemical analysis and the use of Glow discharge mass spectrometry (GDMS) for the trace elements and inert gas fusion (IGF) for the oxygen for the chemical over-check.

The certification received by you for the raw material (attached) is from KME and specifies ASTM B152 which is a specification for OFC Plates. The certification does not list the method used to determine results. The requirements and reported results are below:

ASTM B152:		Cert.	ASTM B170:
Element	Requirement	Reported	Requirements
Cu	99.9%	99.997%	99.99
Sb	4ppm	not reported	4ppm
P	3	1	3
S	15	5	15
Mn	0.5	not reported	0.5
Fe	10	5	10
Ni	10	1	10
Zn	1	1	1
As	5	1	5
Se	3	0-1	3
Ag	25	10	25
Cd	1	0	1
Sn	1	1	1
Te	2	0	2
Pb	5	1-2	5
Bi	1	0	1
O	10	1	5

The measured results agree that to the requirements of ASTM B152, all elements meet the requirements except Mn. Actual measured results report Mn to be in the 1.4-1.6 ppm range. I cannot explain why our supplier did not report Mn and Sb. In addition, all oxygen measurements were reported below 5 ppm except sample Q4 which reports less than 10 ppm. These results meet ASTM B152 but not ASTM B170, however, Oxygen below 10 ppm will not affect brazing.

My only comment is that GDMS is a relatively new process. In fact, an ASTM approved method is still pending certification from ASTM. It is significantly more sensitive and reliable than previous methods.

Once again, the chemical analysis measured results that do not agree with the standard are not significant to the brazing process. But I cannot speak for the other properties required. Trace elements usually affect strength first and conductivity second. I believe that the numbers we are seeing are insignificant.

Bill 4/16/04
William F. Toter
Welding Engineer Sr.
Argonne National Lab
9700 S. Cass, Argonne, IL 60439
wtoter@anl.gov , www.anl.gov/CS
630-252-7342 , fax 630-252-6267 or -4876