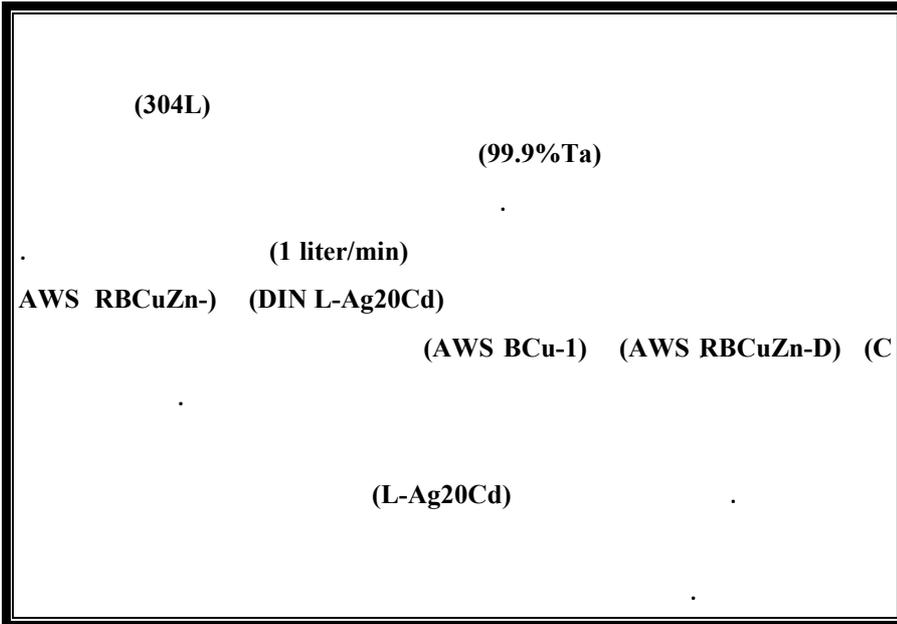


(AISI 304L)

2

1

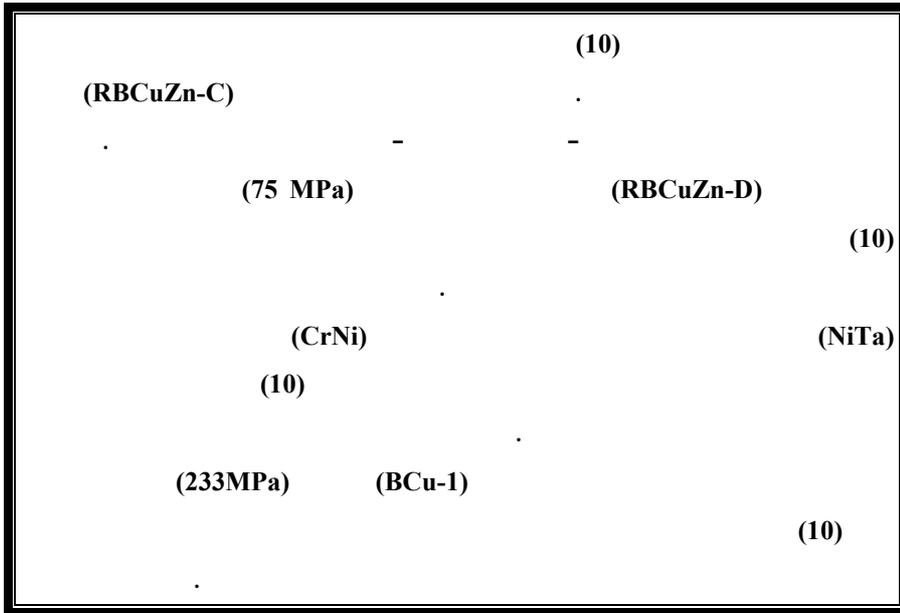
3



1

2

3



Introduction

[1-3]

(HAZ)

[4]

(627°C)

(982°C)

[4]

B-

(1976) [5] V-Ruza Mawe

(B-Ag45CuZn ,B-Ag50CuZnCd ,Ag40CuZnCd)

(AISI 304L)

(1.3%C,35%W,5%Fe,26%Cr,balance Co) (Shields)
[2.5%Sn,5%Al,balanceTi] (Turbine)

.(150 MPa)

(1978) ^[6] V.R Miller

()

(Mutually Soluble)

.(Cu-Zn-Ni)

(1984) ^[7] I.Okamoto T.Takemoto

(Interfacial Corrosion)

(Nickel-depleted Zone)

.(Ag-Cu-Zn)

(1985) ^[4] F.M.Hosking

(BNi-5,BNi-7)

(BNi-3 , Modified BNi-5)

.(AISI 304L)

(AWS BNi-5,BNi-7)

(AISI 304L)

(Cracks)

(AWS BNi-3, Modified BNi-5)

(AISI 304L)

(1986)^[8] A.C. Chilton A.S Wronski R.D. Mottram

(87.7%Cu,6.3%P,7%Sn)

(87.3%Cu,7.1%P,5.6%Sn)

(1993)^[9] S. Liu R.E. Trevisan P.R.C Camargo

(AISI 304)

[Ag-46%Cu]

[Ag-28%Cu]

(15min)

(1994)^[10] H.Ohmura , K.Kawashiri

(AISI 304)

(AWS BCu-1)

(1.04%C)

(Fe-Foil)

(AISI 304L)

(Cr₇C₃, Cr₂₃C₆)

(1999) ^[11] W.Luster, M.Roulin

AL-)

(99.9%Al)

(12%Si

(Fe-Al)

^[12]L.Wang Y.Flom

(10min)

(21MPa)

(2004)

(AISI 347)

(99.9%Pure Silver)

(0.5T Lap Joint)

^[13] E.Lugscheider ^[4] F.M.Hosking

:

(10mm)

(AISI 304L)

(Retort)

(0.15mm)

(1-)

(Muffle Furnace)

(AISI 316)

(1-)

(1 liter/min)

(±1) (K-type)

X-Ray)

(Diffraction Test

(Butt Joint)

,AWS RBCuZn-C ,DIN L-Ag20Cd)

(3,2-) (AWS BCu-1 ,AWS RBCuZn-D

(0.08-0.1mm)

(15X15X10mm)

(304L)

(15X15X0.15mm)

(2-)

)

(

)

(

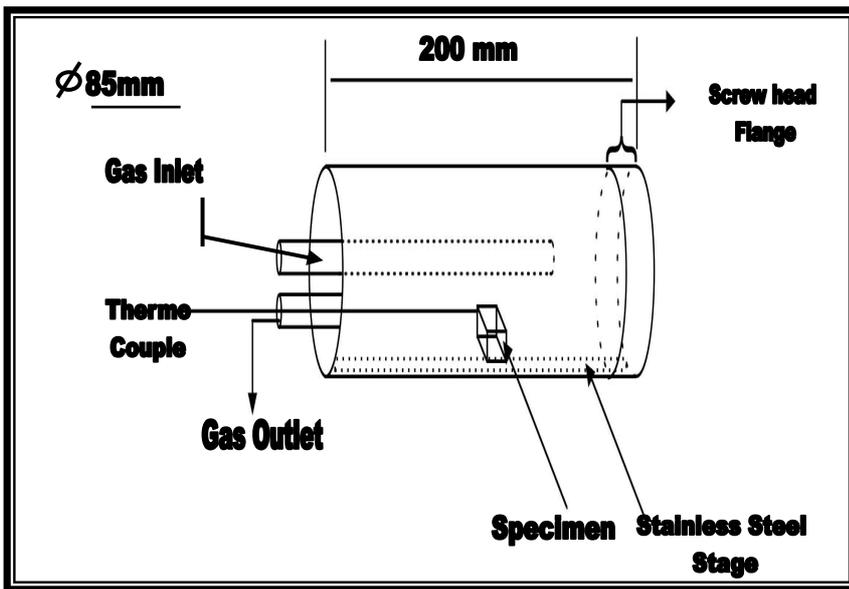
(3-)

(AISI 304L)

AISI 304L

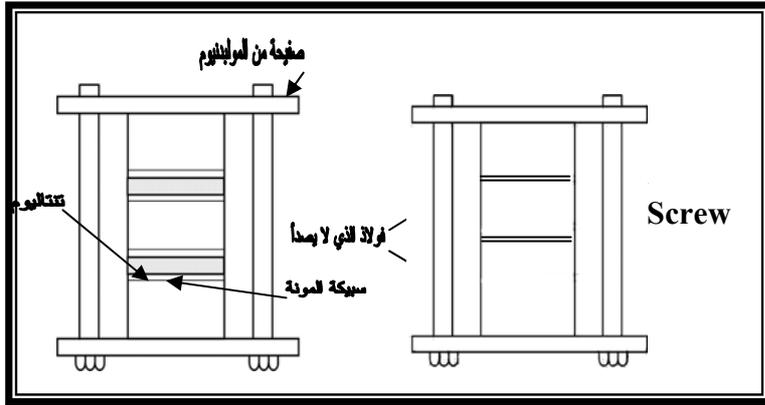
(1)

Element	%C	%Mn	%Si	%P	%S	%Cr	%Ni	%Mo	%Cu	%Al	%Fe
Material Type											
Stainless Steel 304L	0.03	1.48	0.58	0.025	0.01	18.33	8.37	0.2	0.19	0.01	Bal.



(AISI 316)

(1)



(2)

(2)

Brazing Filler Metal	Nominal Composition wt %	Melting °C		Brazing Temperature Range °C
		T solidus	T Liquidus	
DIN L-Ag20Cd	20Ag,40Cu, 25Zn,15Cd	605	765	775-785
AWS RBCuZn-C	46-50 Cu, Zn rem , 0.8-1.1 Sn , Mn 0.01- 0.5 ,Pb 0.05, Al 0.01, Si 0.04- 0.15, 0.5 Other element	866	888	910-954
AWS RBCuZn-D	46-50 Cu ,Zn rem , Ni 9-11, P0.25, Pb0.5 , Al 0.01,Si 0.04-0.25 , 0.5 other element	921	935	938-982
AWS BCu-1	99.9 min Cu, 0.075P ,0.02Pb ,0.01Al ,0.1 other element total	1082	1082	1093-1149

(AISI 304L)

(3)

Brazing Cycle	LAg20Cd	RBCuZn-C	RBCuZn-D	BCu-1
780°C 5min 10min	* *			
950°C 5min 10 min		* *		
975°C 5min 10 min			* *	
1125°C 5min 10 min				* *

Results and Discussions

(AISI 304L)

(99.9%Ta)

(DIN L-Ag20Cd)

-1

(780±5°C)

(5,10min.)

Similar Joining

(5min.)

(columnar intermediate compound)

(5) .(4-)

(780oC) (10min)
(5min)

(6-)

[13]

:Dissimilar Joining

(60%)
(1.98mm/mm.oC)

[4]

(L-Ag20Cd) (4.4mm/mm.°C)

.(8,7-)

(DBST) (10min)

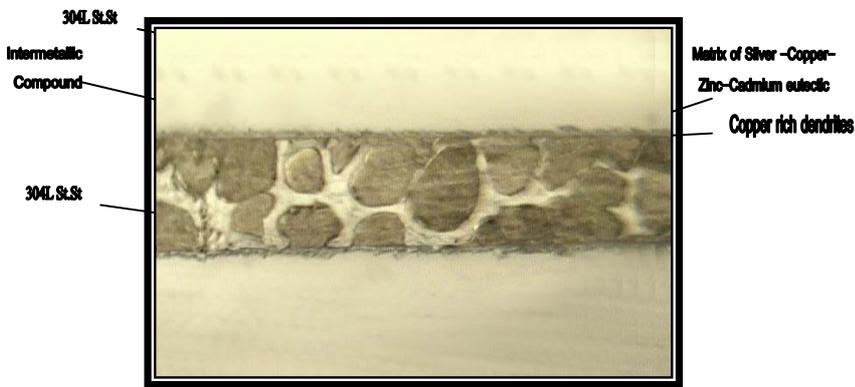
(5 4) (10min)

[13]



(DBS)

(3)

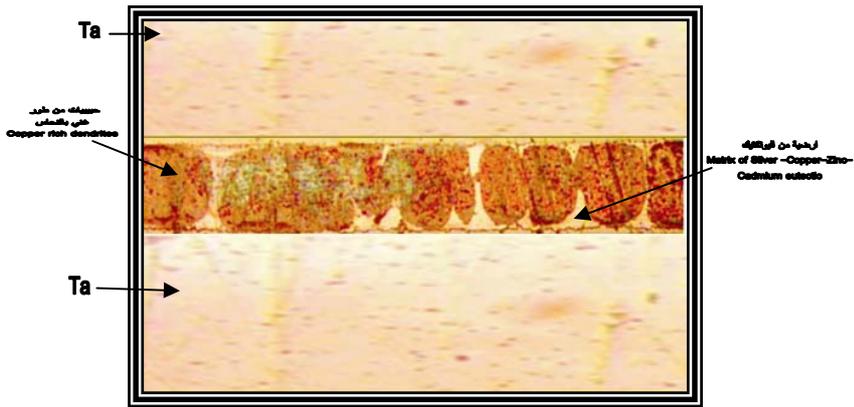


(5min)

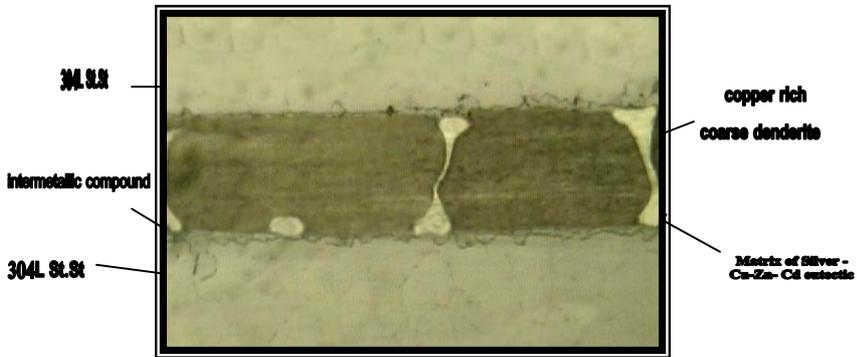
(780OC)

(4)

(X250) (DIN L-Ag20Cd)



(5min) (780°C) (5)
(X250) (DIN L-Ag20Cd)



(10min) (780oC) (6)
(X250) (DIN L-Ag20Cd)

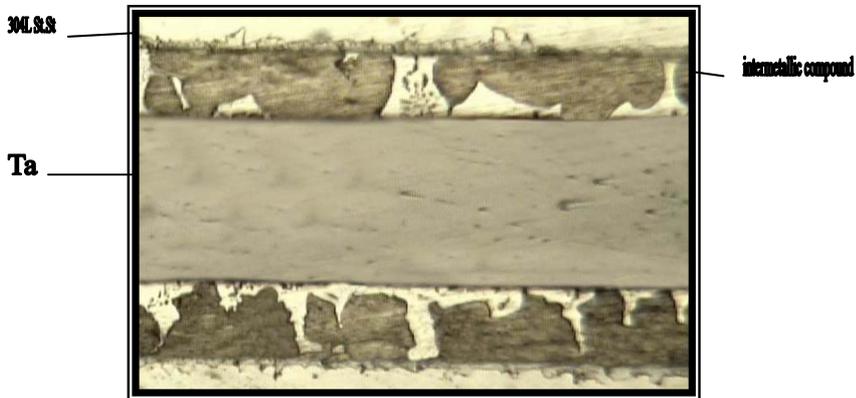


(5min)

(780°C)

(7)

(X250)(DIN L-Ag20Cd)



(780°C)

(8)

(X250) (DIN L-Ag20Cd)

(10min)

(4)

(L-Ag20Cd)

Shear Strength MPa	Brazing Conditions
77	780°C/5min
61	780°C/10min

(5)

(L-Ag20Cd)

Shear Strength MPa	Brazing Conditions
55	780°C/5min
47	780°C/10min

AWS RBCuZn-C

-2

(950±5)

.(10,5min.)

– (5min.)

.(α – Brass)

(-Brass β)

.(10 ,9-)

(10min)

(12 ,11-)

(AISI 304L)

(RBCuZn-C)

(13-)

.(10min)

.(14-)

(16W/mk)

(7) (6)

(10min)

[13]

(AWS RBCuZn-D)

-3

.(10,5min)

(975±5 °C)

(RBCuZn-D)

(9-11%Ni)

(RBCuZn-D)

(15-)

(10min)

(RBCuZn-D)

(16-)

(9,8) (10min)

(9-11%Ni) (RBCuZn-D)

(0.04-0.25%Si)

[14-15]

AWS BCu -1

(1125±5°C)

(BCu-1)

(10 5min)

[13] Dixon

(BCu-1)

($\alpha - Cu$) -

(17-)

(18)

(Reaction Waves)

(10min)

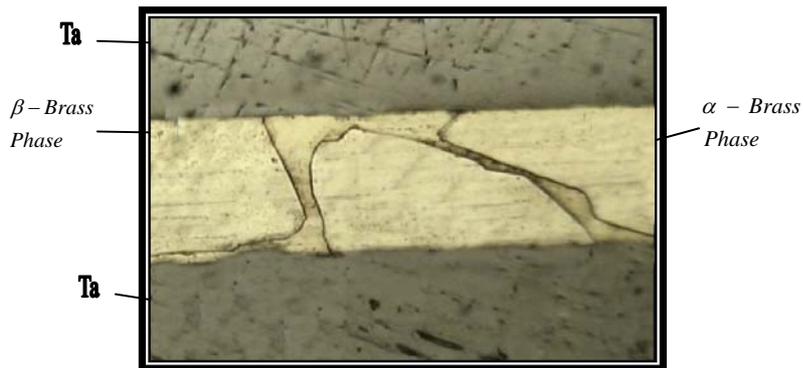


(5min)

(950°C)

(9)

(X250) (AWS RBCuZn-C)

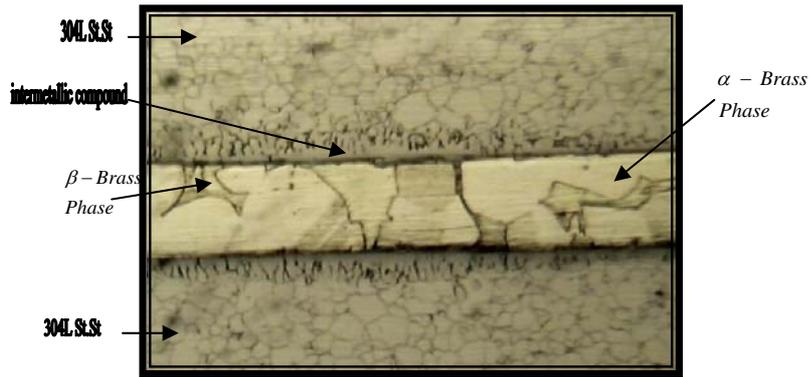


(5min)

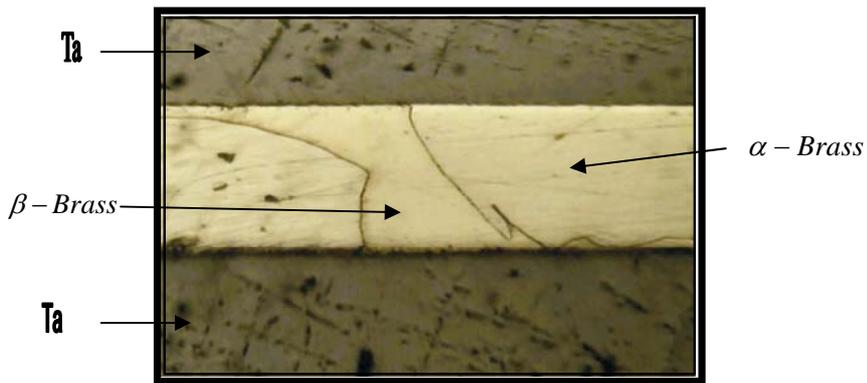
(950°C)

(10)

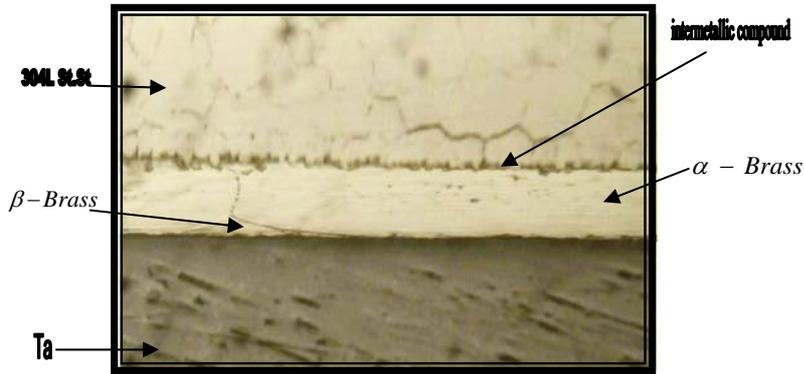
(X500) (AWS RBCuZn-C)



(10min) (950°C) (11)
(X250)(AWS RBCuZn-C)

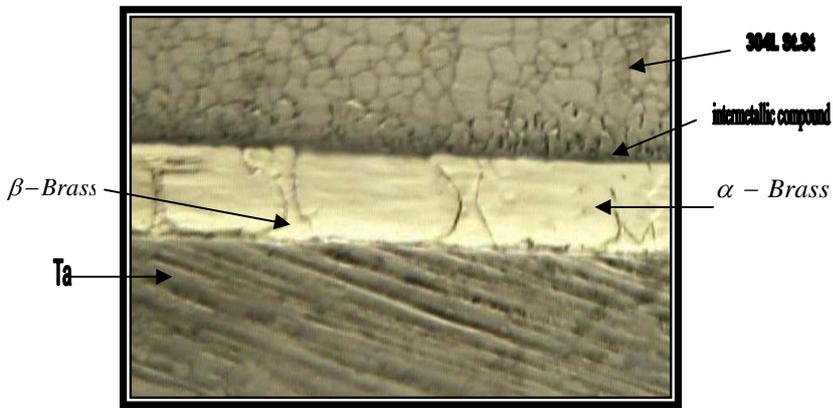


(950 oC) (12)
(X500)(AWS RBCuZn-C) (10min)



(950 °C)
(X250)(AWS RBCuZn-C)

(13)
(5min)



(950 °C)
(X250) (AWS RBCuZn-C)

(14)
(10min)

(6)

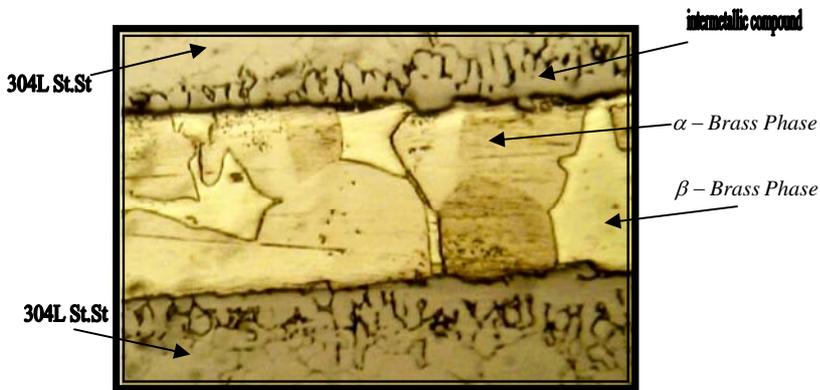
(RBCuZn-C)

Shear Strength MPa	Brazing Conditions
88	950°C/5min
81	950°C /10min

(7)

(RBCuZn-C)

Shear Strength MPa	Brazing Conditions
54	950°C/5min
47	950°C /10min

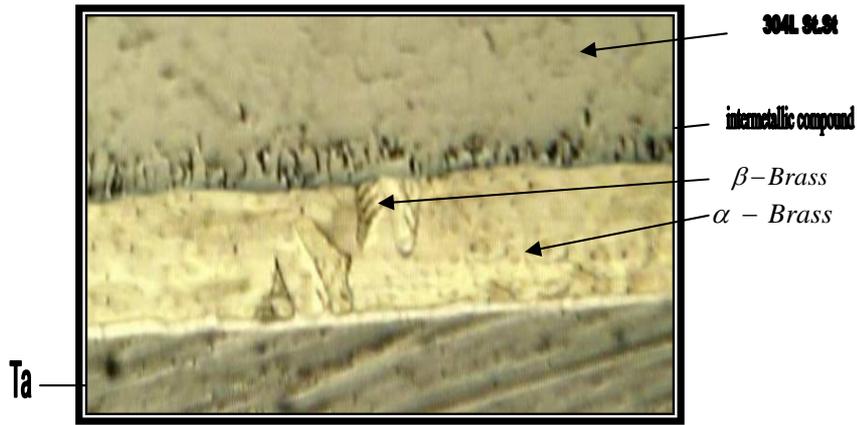


(975oC)

(X500)(AWS RBCuZn-D)

(15)

(10min)



(5min)

(975°C)
(X500)(AWS RBCuZn-D)

(16)

(19-)

(10min)

(11,10) (10min)

AWS BCu-1

(233MPa)

AWS BCu-1 AWS RBCuZn-D

(.23 ,22-)

X-Ray Diffraction Test

(XRD)

(Cu₂Cd,CdCu₂)

(L-Ag20Cd)

(20-) (Matrix of silver- copper- zinc-cadmium eutectic)

(XRD)

α CuZn)

(RBCuZn-C)

(XRD)

(*β* CuZn

(RBCuZn-D)

(NiTa)

()

(XRD)

(*β* CuZn)

(RBCuZn-D)

(Copper-zinc matrix)

(CrNi)

(.10min)

(75MPa)

(XRD)

(AISI 304L)

(BCu-1)

(233MPa) (200MPa)

(10min)

(8)

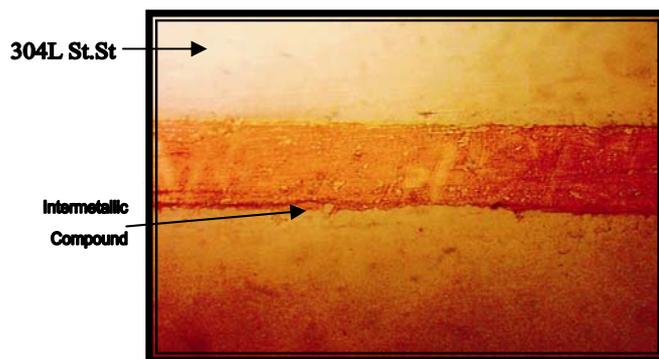
(RBCuZn-D)

Shear Strength MPa	Brazing Conditions
113	975°C/5min
128	975°C /10min

(9)

(RBCuZn-D)

Shear Strength MPa	Brazing Conditions
58	975°C/5min
75	975°C /10min

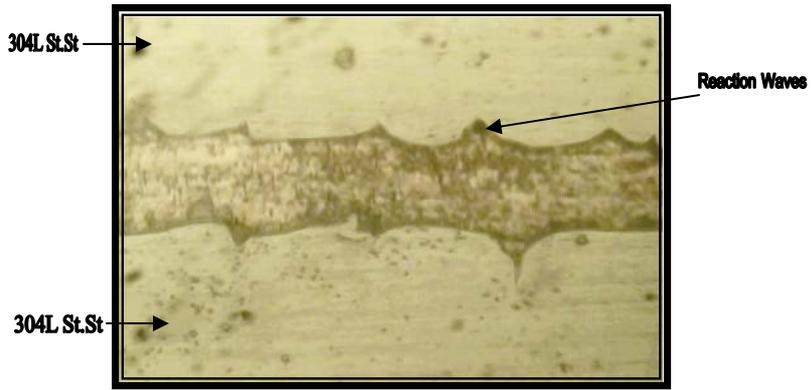


(5min)

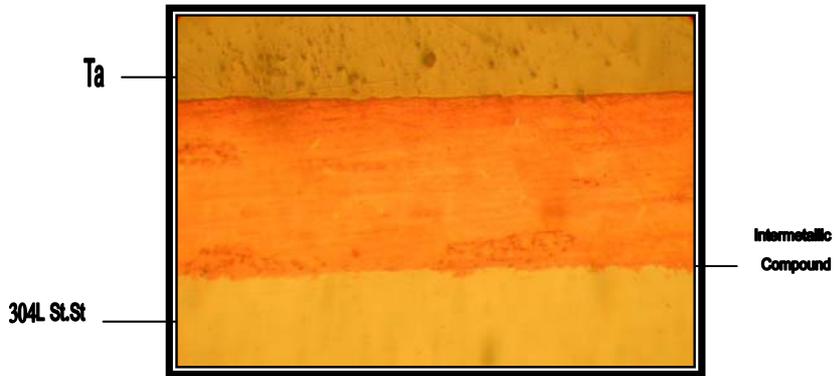
(1125oC)

(17)

(X250) (AWS BCu-1)



(1125oC) (18)
(X250)(AWS BCu-1) (10min)



(1125oC) (19)
(X500)(AWS BCu-1) (5min)

(10)

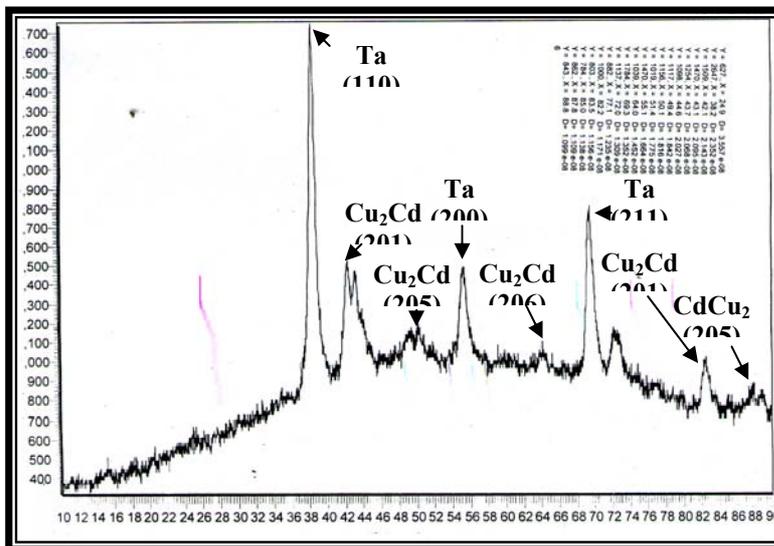
(BCu-1)

Shear Strength MPa	Brazing Conditions
200	1125°C/5min
233	1125°C /10min

(11)

(BCu-1)

Shear Strength Mpa	Brazing Conditions
51	1125°C/5min
69	1125°C /10min



[XRD] (20)

(10min)

(780oC)

(L-Ag20Cd)

Conclusions

-1

(DIN L-Ag20Cd, AWS

RBCuZn-C, AWS RBCuZn-D, AWS BCu-1)

AISI 304L

-2

:

(DIN L-Ag20Cd)

-

()

(AWS RBCuZn-C, AWS RBCuZn-D)

-

β α

10

(75 MPa)

(AWS BCu-1)

-

(AISI 304L)

10

(233 MPa)

(CrNi + NiTa)

-3

(75MPa)

(RBCuZn-D)

.(10min)

(AWS BCu-1)

-4

.(10min)

(233MPa)

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